Clapp Memorial Library

Conditions Assessment

A review of existing conditions

and prioritized recommendations for treatment

of the historic Clapp Memorial Library

July 29, 2015

Prepared for:

The Board of Trustees of Clapp Memorial Library

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CME

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3 EXECUTIVE SUMMARY

The Clapp Memorial Library is a significant structure within the National Register Belchertown Center Historic District. Completed in 1887, the Richardsonian Romanesque building, designed by Henry Franklin Kilburn, is a bequest to the town of Belchertown by John Francis Clapp, successful NYC merchant and native son.

A private entity, the library is governed by a Board of Trustees who actively advocate for library resources. Recognizing that, while the building itself is a significant asset, its specialized upkeep is a drain on financial resources that could be directed to library programs and facilities, the Board of Trustees contracted with CME Architecture, Inc. in December of 2014 to perform a detailed conditions assessment. The purpose of the assessment along with treatment recommendations and a prioritized preservation plan is to identify the requirements and associated costs to preserve and maintain the building.

The CME team consisted of a historical architect, structural engineer, mechanical and electrical engineers, preservation consultant, and stained glass specialist each of whom surveyed the property to assess existing conditions in a noninvasive manner. The findings of these studies are presented in the body of this report as well as in the Appendices.

The following document includes a prioritized plan for implementation of historically appropriate treatments and the development of systems for code compliance. Design and construction budget costs were developed, reflecting the prioritized plan of action, totaling $503,000 over the course of the next 10 years. A cyclical maintenance plan developed specifically for the library will assist the Board of Trustees in maintaining the building and the investment in preserving this significant and beloved community asset.

4 PROJECT DESCRIPTION

Chronology of Development and Use

The Clapp Memorial Library was founded through a bequest of $40,000 from John Francis Clapp for the purpose of establishing a public library in his native town. By “judicious investment” the trustees increased the amount to $46,600 and under their supervision the building was commenced in 1883 and completed in 1887. The building is constructed of Longmeadow brownstone and is in the form of a Latin cross one hundred and two feet in length and from forty to fifty five feet in breadth with an octagonal tower sixty five feet in height. As originally designed, the reading room and the stage on the first floor were arranged so that the spaces could be drawn into one large audience room capable of seating five hundred persons.

When the library opened, shelf capacity was 15,000 volumes which could readily be increased to 30,000 given the commodious plan. A memorial window was installed in the north wall of the stage by Susan M. D. Bridgman in memory of her late husband, Calvin Bridgman. A memorial window in the south wall of the reading room commemorated the founder of the library, John Francis Clapp, and was erected by his brothers. The Clapp Memorial Library was incorporated by chapter 134 of the Acts of 1887 and the corporate members then were Everett Clapp, president, Susan Bridgman, E.L. Clapp, Dwight P. Clapp, Rev. Payson W. Lyman, and Nathaniel Dwight. The chairman of the selectmen of the town was to be a member ex officio. The Clapp library absorbed the small libraries of the Young Men’s Christian Association and of the local agricultural society.

The building was designed by Henry Franklin Kilburn, FAIA, a New York architect born in Ashfield, MA in 1844. After serving in the Civil War, Kilburn studied and practiced architecture in Northampton, MA until 1869 when he established his practice in NYC. Known for his large public buildings and grand residences, his designs were based on the styles of well-known architects of this time including H. H. Richardson, and McKim, Mead and White. The Clapp Memorial Library is among the Kilburn structures that was designed in the style of Richardson known as Richardsonian Romanesque. The Romanesque style is characterized by heavy, asymmetrical massing of a rough stone field with flat stone trim, typically emphasizing horizontal elements. Arched windows and entrances along with steep roofs and tower elements also prevail within this style. The building was listed on the National Register of Historic Places in 1982 as a contributing structure within the Belchertown Center Historic District.

Only minor modifications to the building have taken place since the building was constructed. In 1999 the addition of an exterior ramp system on the east side of the building, the installation of a Limited Use/Limited Application (LULA) lift, and the inclusion of code compliant toilet rooms, provided accommodation for universal accessibility to all of the library's floor levels and facilities.

Based on an earlier space needs study, conceptual architectural plans were developed in 2002 for a major addition to the east to allow for expansion of the Children's Area, Computer Room, Quiet Reading Area, Meeting Rooms and support facilities. These plans were not realized and the library continues to operate within the footprint of the original building despite space constraints and minimal function areas.

Character Defining Features, Materials and Finishes

Historic building fabric defines the heritage of our built environment and provides context. It gives a building character, texture and authenticity. Historic fabric is a term used quite regularly in the historic preservation world but defining it is not as easy as one might think. McGraw-Hill's Dictionary of Architecture and Construction defines historic fabric as "those portions of a building fabric that are of historic significance."

The Secretary's Standards address significance and they identify four strategies for effectively dealing with historic buildings: preservation, rehabilitation, restoration, and reconstruction. The first approach, preservation, is the most desirable and "places a high premium on the retention of all historic fabric through conservation, maintenance and repair." Further: "It reflects a building's continuum over time, through successive occupancies, and the respectful changes and alterations that are made."

Modifications and alterations to the building are acceptable provided that they respect the historic fabric and do not detract from the collective visage of the structure. It is the general recommendation of this study that the materials and systems of the building be preserved and changed as little as possible. Materials, features and finishes of significance are identified below.

Exterior

The Clapp Memorial Library is not entirely atypical of other Richardsonian Romanesque buildings of the era, but it has some interesting differences. Many architects favored the use of Longmeadow brownstone for the stone trim and details, and granite (often pink from Milford, Massachusetts) for the field, as is the case with the Hampshire County Courthouse in Northampton, also designed by Kilburn. At Clapp Memorial Library, the same stone type is used throughout and the differentiation is made by the finish left by the masons—smooth for belt coursings and trim, rough for the field. This effect is further enhanced by the manner in which years of water staining has discolored the stone differently.

Absent from the bases of the low-springing, radial arches are the clusters of short columns typical of this architectural style. The exception is found within the mass of the Palladian window over the main entrance. There a relatively simple, undecorated colonnade is found that bears the load of the arches. Otherwise, massing and styling of the fenestration is typical.
Mortar joints are colored to blend, rather than contrast, with the stone. This effect is achieved by grinding brownstone flakes and remnants into a manageable size for use as the aggregate. As much as 80% of the appearance of mortar color is dictated by the aggregate, and architects like Richardson knew that the finished product was more consistent and aesthetically pleasing than the use of dyes or pigments. While the original grapevine joints were finished with a raised bead (still seen in select areas) the majority have been repointed and struck flush.

The scalloped-shape clay tiles are relatively unusual, not just for the style, but for any time or era. The use of clay tile, itself, is not. Richardsonian Romanesque buildings typically feature red and/or black slate or red clay tile. Indeed, all of Richardson's roofs featured clay tile and terra cotta details from Boston Valley in Western New York or slate. The slate specified was almost exclusively red, from Granville, New York, or black from the Monson region in Maine. A couple of his early buildings, before Monson slate became widely available in 1872, were clad in purple slate from Wales. In other of Kilburn's buildings, it is documented that he used terra cotta tiles for the NY Architectural Terra Cotta Company. Further research could associate this origin with the library roofing tiles.

The lantern, centered on the two-storied gabled entrance piece, yet set back at the main ridgeline, is a multistoried octagonal tower with double hung windows surrounding the middle of the structure. Decorative fascia and gabled elements over each face of the octagon culminate in a steeply pitched roof topped with a copper weathervane.

Decorative window sash in the lantern and within the major front hipped roof gable feature smaller lights in the margins, divided by muntin bars, surrounding a larger pane of glass in the center. This type of sash is more often found with and typical of the Queen Anne style. This motif is consistent throughout the fenestration and carried through the stained glass windows and fixed transoms over doors.

Figure 1 - The lantern is a major character defining feature of the building.

Figure 2 - Rusticated and decorative Longmeadow brownstone typifies the building style.

Interior

Resembling a Latin cross, the vaulted, two-story library interior houses a variety of purpose built spaces. A stage to the north, once used for cultural performances, now serves as the Children's Reading Room and is flanked by an office for the Children's Librarian to the west and an elevator and stair hall to the east. The base of the cross houses the book stacks and surrounding reading areas. The western arm of the cross is the formal entrance vestibule from the street while the eastern arm is a Reading area.

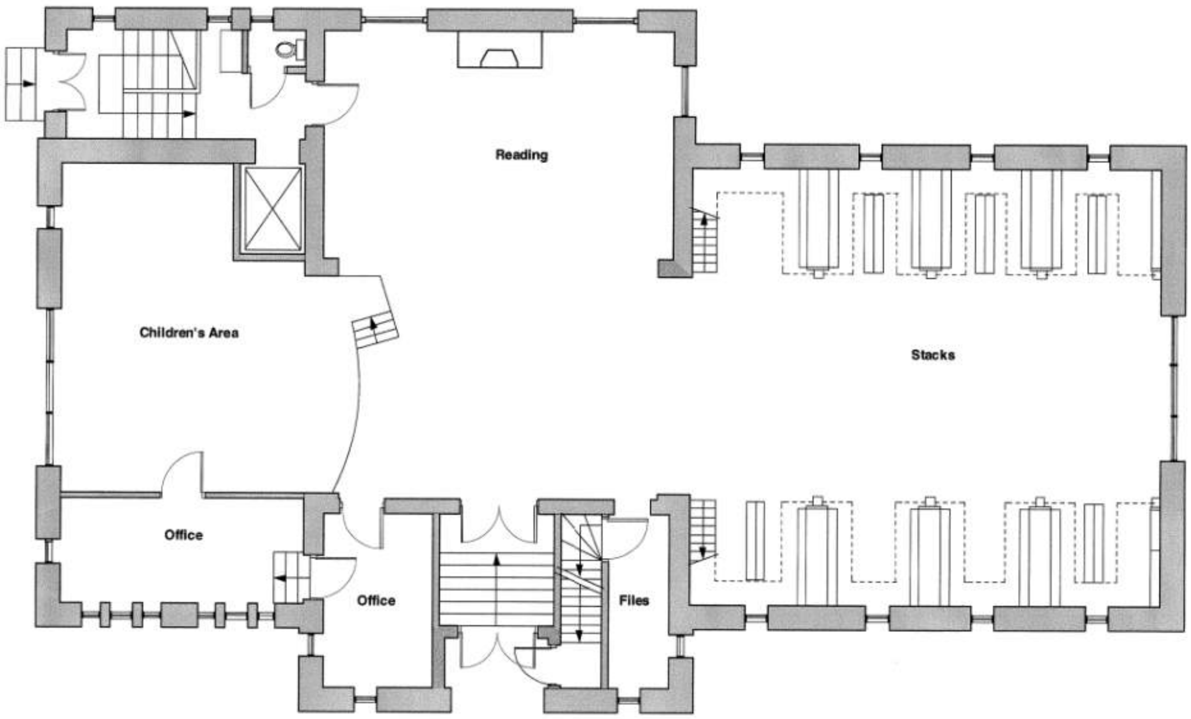

Figure 3 - First Floor Plan

In addition to the classic form of the plan, character defining features of the interior include the two-story coffered ceilings of the main level. High plaster arches disguise structural elements and provide a visual separation between the three main spaces. Dark stained arched and embellished trusses in the Stack Area are integral structural framing elements that provide distinctive visual interest. Two-story book stacks along the east and west perimeter of the Stack Area are purpose built elements. The upper stacks are accessed by narrow staircases and balconies which are given headroom and light by means of hipped roof dormer windows on either side. The stained glass window, "Poetry" is a massive focal point at the south end of the room, scaled to match the two-story space.

The stage area on the north end of the building is similarly defined by a second large stained glass window. The main Reading Room is symmetrically balanced by the formal entrance to the west and the red brick, wood mantled fire place to the east. Natural light is integral to the design and is provided by large double hung windows at the main floor level and clerestory windows above. Other character defining features include the stained glass lay lite central to the two plan axis, and the decorative wood beaded screen which visually separates the Reading Room from the Circulation Area. Wood paneled doors, wrought iron balcony railings and wood wainscoting contribute to the overall richness of the space.

Figure 4 - Two story main floor spaces provide a sense of grandeur. Balconies provide limited access to second level book stacks. Dormer windows and decorative pendant fixtures provide illumination.

Due to the two-story space within the main building mass, the second floor area is limited to a room above the main entrance hall which was originally used as the Trustees' meeting room. Today it serves as the office of the Director of the library and includes a small conference room. Other second level spaces include the mezzanine book stack area to the south, accessed by narrow staircases on the east and west sides of the structure.

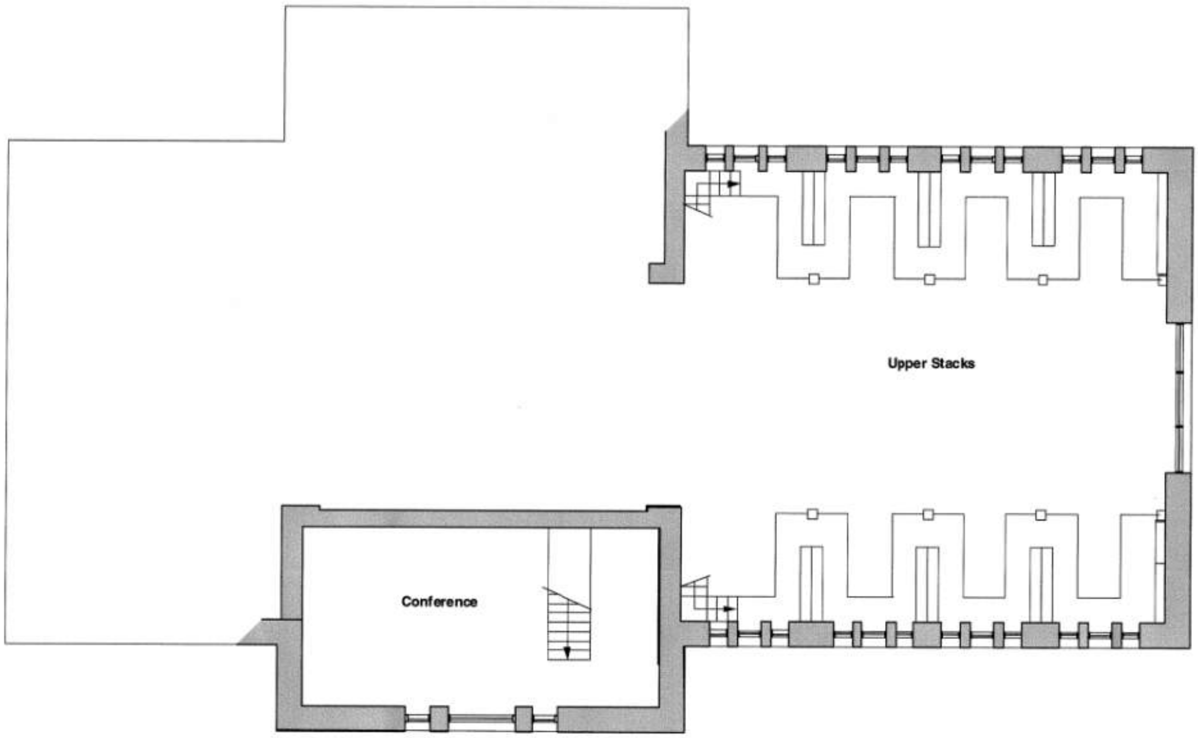

Figure 5 - Second Floor Plan

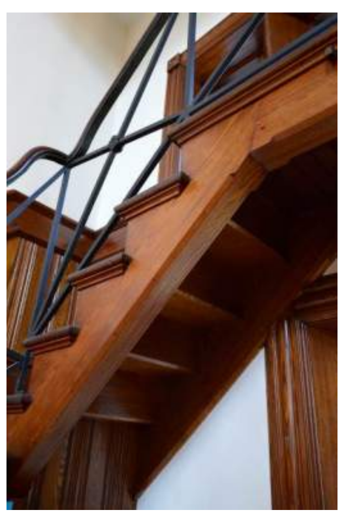

Figure 6 - Wrought iron stair and balcony railing are delicately detailed.

The lower level spaces are one half story below grade allowing for daylighting opportunities at the basement level. Initially housing a classroom and mechanical/storage space, these areas now provide space for the Children's Activity Room as well as storage for the fund raising book sale event and mechanical systems. Massive brick piers define the structural grid while tall plaster finished ceilings allow for functional height and daylighting opportunities.

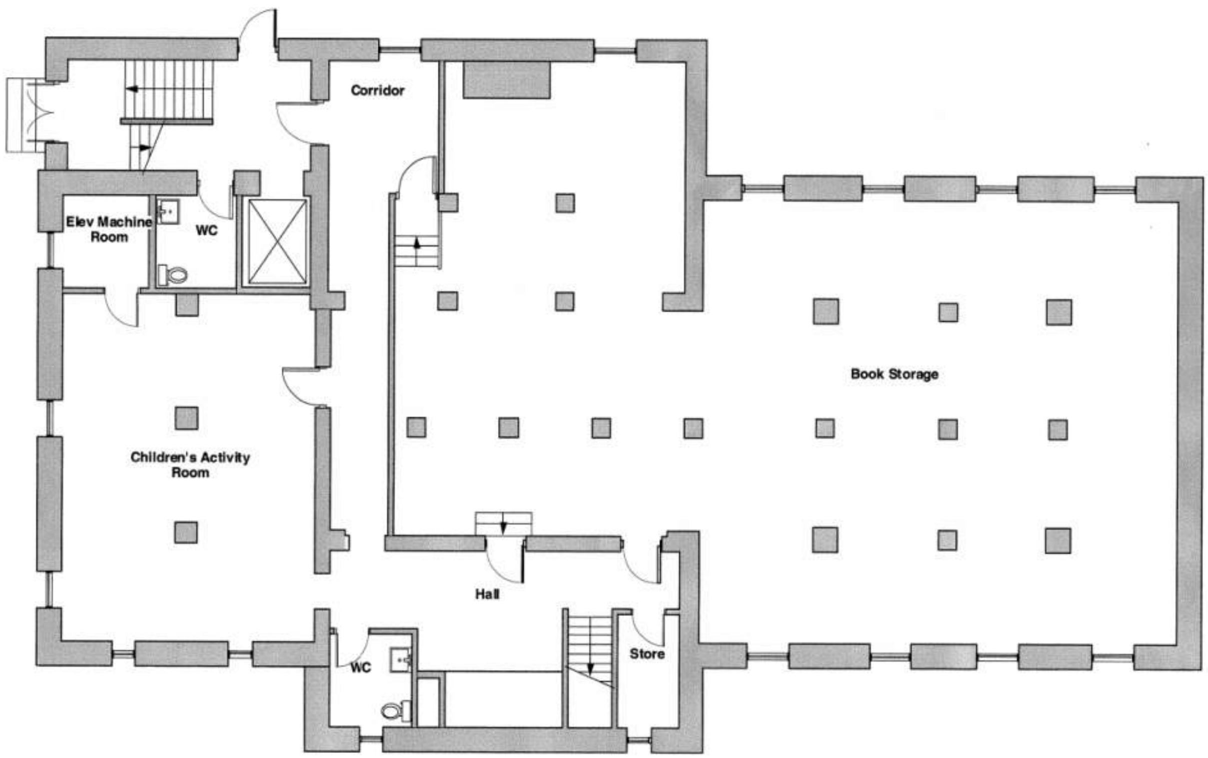

Figure 7 - Lower Level Plan

Figure 8 - Book Sale storage takes up the majority of basement space.

1 CONDITIONS ASSESSMENT AND TREATMENT RECOMMENDATIONS

ASSESSMENT OF CONDITIONS

During the conditions assessments, the various systems of the building envelope were examined for present condition and performance. Each was evaluated in context relative to its importance as an element of the building and assessed based on known, acceptable standards, and described according to subjective terminology. Loosely defined, these terms are:

Excellent … the brief moment that a system is brand new or completely restored; this condition descriptor is symbolic only.

Very good … the next moment, after the new or restored system is completed; regular inspections will suffice until maintenance is required.

Good … a system that is functioning properly and routine maintenance is needed; painting, replacing slates and repointing masonry are maintenance tasks.

Fair … a system that is functioning adequately but work is needed, beyond routine maintenance, to improve system performance.

Poor … a system that is not functioning adequately; significant work will be needed to restore the system to an acceptable condition.

Very Poor … a system that is not functioning or absent; wholesale replacement of some or all of the components of the system are necessary.

Using the above-described criteria for evaluating conditions, the various tasks to bring all systems to a 'good' or better condition are then described in detail in the Recommendations section. The recommendations are for historically appropriate treatments. The criticality of fully restoring each as a functioning element of a building system is also prioritized accordingly. The descriptors assigned to each should be viewed independently and are not assigned relative to importance.

OVERVIEW OF APPROACHES TO TREATMENT

The Secretary of the Interior provides four distinct but interrelated approaches to the treatment of historic properties. Each is defined, below, so that the recommendations of this conditions assessment can be weighed and considered in context.

> *Preservation* focuses on the maintenance and repair of existing historic materials and retention of a property's form as it has evolved over time;
>
> *Rehabilitation* acknowledges the need to alter or add to a historic property to meet continuing or changing uses while retaining the property's historic character;
>
> *Restoration* is undertaken to depict a property at a particular period of time in its history, while removing evidence of other periods; and,
>
> *Reconstruction* re-creates vanished or non-surviving portions of a property for interpretive purposes.

The general recommendation of this report is to preserve and maintain the building as it appears. This means replacement of elements of the various systems that have outlived their useful life with new materials of the same kind if possible. For example, if the sheet metal roof flashings are approximately 75 years old and allowing water infiltration then they must be replaced. The flashings must be replaced in kind, with the same sheet metal material and installed in the same form and dimension as the details and assemblies they replace.

All recommendations are in accordance with guidelines set forth by the National Park Service of the U.S. Department of the Interior.

NARRATIVE DESCRIPTION OF FEATURES, CONDITIONS AND RECOMMENDATIONS FOR TREATMENT

EXTERIOR

- ***SITE CONDITIONS***

  Conditions

  Directing water runoff, primarily from roof surfaces, is critical to the health of both interior and exterior surfaces and finishes. Copper gutters and associated downspouts are in place along the roof eaves. Many of the downspouts are booted into an underground drainage system of unknown design and outlet. Two downspouts on either side of the front entrance gable are not directed to underground drainage and the runoff flows over the lawn and access walk leaving debris and potential icing in its path. Erosion of the soil at the base of the exterior walls has exposed the field stone foundation which is now vulnerable to water infiltration. Copper gutters at the valley between the main gable entrance element and the north and south wings have been damaged due to heavy ice and snow fall in recent years.

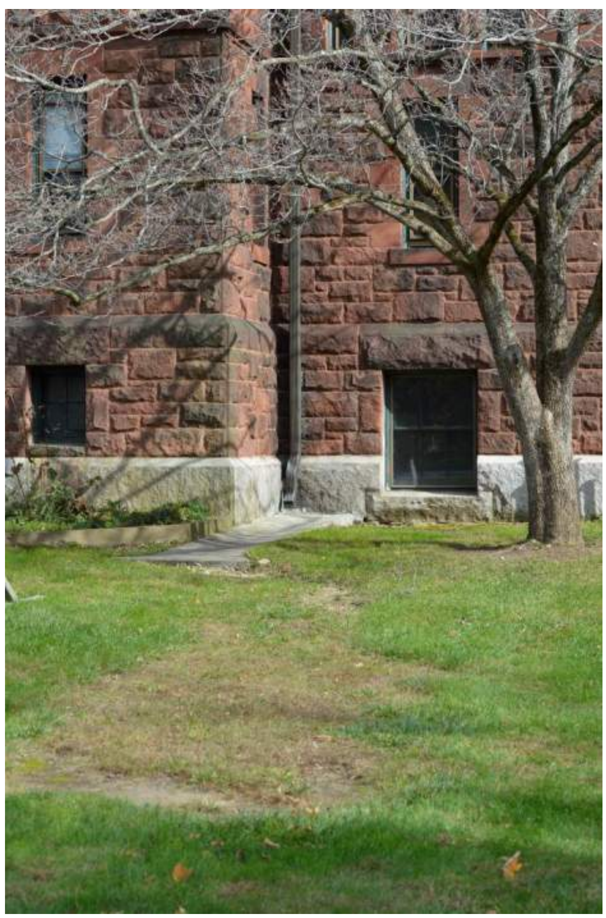

Figure 9 - Roof drainage systems empty across the lawn and the north entrance walk.

A linear drain at the base of the access ramp on the north east side of the building was designed to collect water running off the ramp and carry it to an outfall on the east side of the ramp. This system may be undersized as water does not always drain away completely.

Figure 10 - A trench drain at the base of the entrance ramp requires vigilant cleaning to function properly.

There is an indication in the parking lot that the single catch basin is not adequate to collect and move water off the asphalt surface.

Exterior accessibility routes are no longer code compliant.

Figure 11 - Signage and striping should be upgraded for code compliance.

Recommendations

The issue of mortar joint deterioration with the masonry, and paint and wood failures with the carpentry and trim, may be exacerbated by the poor control of rain runoff. Implementation of the following recommendations will help to assure a water tight building envelop and adequate site drainage.

- Repair and provide adequate support for the copper gutters at the front valleys.
- Investigate existing underground drainage systems to insure that they are running freely to daylight or to a working yard drain.
- Regrade areas adjacent to the building to achieve positive drainage away from the building.
- Redirect the front leaders underground to yard drains beyond the north-south access walk.
- Insure that the linear drain at the base of the entrance ramp is clear of debris on a regular basis. Snake the drain line on a yearly basis to insure free drainage.
- Upgrade striping and signage at the van accessible parking space.

Figure 12 - Surface drainage should be channeled underground to eliminate runoff across walking surfaces.

- ***ROOF***

Conditions

The *clay tiles* of the front roof system are in fair condition. There are many broken and/or missing pieces to be replaced. The *asphalt shingle* roofing on the rear of the building, installed in 1996, appears to be in good serviceable condition. Prior to the 1996 project, this roof was clad in clay tiles. Slate and clay tile make roofs water tight, not air tight. Asphalt shingle materials tend to last twenty years on older building stock because of the passive ventilation that characterizes such buildings is minimized. All *flashing assemblies* appear to be in good condition. Monitor this roof and anticipate replacement.

Figure 13 - Clay tile roof shingles are decorative and also fragile.

Recommendations

- o Remove and replace broken clay tiles on the front roof of the building. Replacement should be performed with closely matching tiles. Some stock is found in the basement of the library. If more pieces are needed than available, salvage dealers should be contacted in an effort to find an exact match.

- Monitor the condition of the shingle roof once per quarter and after a major weather event. This portion of the roof is almost 20 years old. Replacement in the next 10 to 15 years should be planned.

- Inspect the metal flashings on a quarterly basis. While a major restoration of the roof took place less than twenty years ago, *flashing assemblies* should also be monitored and inspected regularly. When replacement is necessary, they should be replaced with new, 20 oz/sq’ copper materials and 48 oz/sq’ sheet lead. At the time of work, decking and wood blocking should be inspected for rot and replaced in kind. Ice and water shield is applied to the deck and sides of any protrusions that are to be covered with copper flashing materials. 30# felt paper should cover the membrane and act as a break between the sheet metal and ice and water membrane.

Figure 14 - The asphalt shingle roof on the rear of the building is a substitute for the original clay tile roof. This roof is 20 years old and will be in need of replacement in the next 10 years.

- ***GUTTERS AND DOWNSPOUTS***

  Condition

  The *gutters and conductor pipes*, overall, are found to be in good condition. One section at the intersection of the gable entrance roof and the main roof on either side has been severely damaged by ice and must be replaced. When calculating drainage capabilities, one square inch of outlet opening is required for each 100 SF area of roof surface being drained. Hence, the outlets and conductor pipes are more than adequate to service the roof surface area.

  Recommendations

  - As recommended in the site drainage section, damaged gutter intersections should be replaced in kind.
  - Copper wire strainers should be installed at each outlet and checked biannually.
  - Clean the gutter troughs annually.

Figure 15 - Copper gutters damaged by ice damming should be replaced.

- ***EXTERIOR STONE MASONRY***
  Conditions
  The *stone masonry* of the walls is in good overall condition with some localized issues that would be best described as fair. Some repointing is needed, and cracks are visible that warrant further investigation.

Figure 16 - Past repointing is visible as are stress cracks due to settlement. Areas requiring repointing are limited but occur throughout the facade.

The *granite water table* at grade is in good condition. Some repointing is needed. The larger concern is portions of the foundation that have become exposed as uncontrolled drainage has caused the grade to erode.

The *brick masonry* within the outer vestibule at the front door is in good condition for the most part. At the bottom, the use of salt has caused mortar degradation such that is elevates the condition to poor. Like the stone masonry, above, empty or failing mortar joints should be repointed as needed.

At the rear of the building there are large coping stones at the gable roof ends which have become displaced. Throughout the façade, the joints in the coping were observed to be entry points for precipitation and the cause of saturation within the wall system.


Figure 17 - Displaced coping stones on the gable ends should be reset and re-mortared.

With respect to the *stone walls* of the building, there are cracks in specific locations that may be directly attributed to building settlement. Tell-tale gauges should be installed and monitored through four seasonal changes to detect any movement. Each week the gauges are manually inspected and findings recorded. For the sake of continuity and consistency, every effort should be made to minimize the number of individuals performing the inspections.

Given the need for increased site drainage it is possible that heaving is occurring and causing movement in the foundation. Detection of movement is an indicator that a structural engineer should be consulted. Once it has been established that there is no movement, the cracks in the stone should be filled with an epoxy or low-shrinkage grout to prevent further water infiltration.

Recommendations

- Empty or failing mortar joints should be repointed as needed. The mortar should be tested for composition and appropriate recipe specified for repointing according to ASTM C-1324-03 Standard Test Method for Examination & Analysis of Hardened Masonry Mortar by a qualified materials conservator. The material must also be sympathetic in texture, color, strength and appearance to that in adjoining areas.

Prior to wholesale use of the new replacement mortar, a mock-up sample should be installed by a qualified craftsperson who understands the curing and application details of restoration masonry work. Once the mock-up sample is installed, appropriate precautions should be taken to ensure that the mortar is protected from wind, sun, rain and frost to enable slow curing to take place. The sample should be allowed to cure in the wall for a minimum of seven but preferably fourteen days before final color match is approved.

The failing and deteriorated mortar joints should be cleared by skilled masons with hand tools—not grinders and powered chisels. Joints should be cleared to a depth of roughly twice the height or width of the opening (i.e., a 3/8" joint should be ¾" deep before repointing takes place.) The mortar should be tooled into the joints in ¼" lifts and allowed to set up until pressing with force is required to leave a fingerprint.

Joints should be struck flat, revealing slightly the edge of the facing stone, to match unrepaired mortar joints in adjoining areas. Any mortar or residue left behind should be cleaned with a brush or sponge and clean, warm water. The new work should be protected from direct sunlight as it cures. Dampened burlap works well to shade the surfaces, and should be wetted regularly to prevent drying out.

- Coping stones at the gable ends should be removed and reset. All coping joints should be cleared and pointed with an appropriate strength mortar. Horizontal joints should be raked to a depth of one inch. Backer rod should be installed and topped with a commercial grade, mastic sealant. A "T"-shaped, lead weather cap that spans the entire joint should be pressed into the mastic before it cures.

- The building should be cleaned of biological growth which retains moisture and does not allow the wall system to dry thoroughly. After repointing the building facades should be cleaned with the gentlest water wash possible, preferably 100 psi but not more than 300 psi. A natural or synthetic brush can be used to clean the surfaces. Metal brushes should be avoided as they may leave metal particles that could damage and stain the masonry.

- Monitor the stress cracks and joints in the façade that are potentially related to building movement.

Figure 18 - Biological growth should be removed from the building using the gentlest possible means.

- ***STEPS***

  Conditions

  The granite *front steps*, while currently in fair condition, are in jeopardy. They are deteriorating because of the use of salt in the winter. The sodium chloride causes "sugaring" to occur—a breakdown in the matrix of the stone that turns granite into powder. Additionally, failure to maintain the railings is causing rust stains to appear. When the cast iron posts mounted in the granite rust and expand they will cause the stone to spall and crack, further deteriorating the stone.

  Recommendations

  - As an alternative to sodium chloride, calcium chloride should be used to assist in the melting of ice.

  - Cast iron handrails should must be cleaned of rust with a wire brush and an appropriate, direct-to-metal (DTM) paint applied.

Figure 19 - Sugaring of the granite steps is due to the use of calcium chloride which should be avoided.

Figure 20 - Rust should be removed from wrought iron railings to prevent spalling of the stone.

- ***WINDOWS***
  Conditions
  The *window* condition ranges from fair to very poor. In the tower, for instance, there is a window missing. Nearby, a storm window is missing. There are varying degrees of loss of coatings (paint, varnish and stain) on the doors and windows. Wood rot is also detected throughout due to failed paint coatings.

Figure 21 - Wood window sash and surrounding framing and trim should be reglazed and repainted.

The original wood sash, storm panels, sills and trim should be retained to the greatest extent possible. Old growth wood windows are significantly stronger and more durable than new wood sash. Replacement sash should never be considered as an option for improvement as additional framing within the opening will reduce the opening size detract from the visual composition of the façade.

Recommendations
- All windows should be restored appropriately and re-glazed when needed. Repairs to wooden windows are usually labor intensive and relatively uncomplicated. The routine maintenance required to upgrade a window to

"like new" condition normally includes: some degree of interior and exterior paint removal; removal and repair of sash (including re-glazing where necessary); repairs to the frame; weather-stripping and reinstallation of the sash; and, repainting. These steps are listed for a typical double-hung wooden window, but they are easily adapted to other window types and styles as needed.

- Appropriate weather-stripping should be applied on the inside and out. All actions that involve the handling of wood must be performed in full compliance with Massachusetts' 'De-leading and Lead-Safe Renovation Regulation,' and the EPA's Renovation, Repair and Painting (RRP) regulations by a licensed, 'Lead Safe Renovator' if testing detects the presence of lead. Missing/broken glass of the aluminum storms should be replaced as needed. Some of these actions, such as the basic repairs to the storms, can probably be performed by volunteers or Town maintenance employees.

- Exterior storm windows on all of the windows should be continued as part of an energy saving and materials conservation plan. Exterior storms protect the original windows, allowing the newly restored windows to last another 200 years. There are several "invisible" storm window options available for historic buildings. While interior storm windows appear to be an attractive option for achieving double-glazing with minimal visual impact, the potential for damage caused by condensation must be addressed.

  Moisture, which becomes trapped between the layers of glass, will condense on the colder, outer original window, and has the potential to cause deterioration. The correct approach to interior storm window use requires the creation of a seal on the interior storm while allowing some vapor to escape around the prime window. In actual practice, the creation of such a durable, airtight seal is difficult and there is no protection of the historic original windows from the elements. This system requires a level of vigilance with respect to inspection and upkeep that is not conducive to institutions that have difficulty maintaining their buildings.

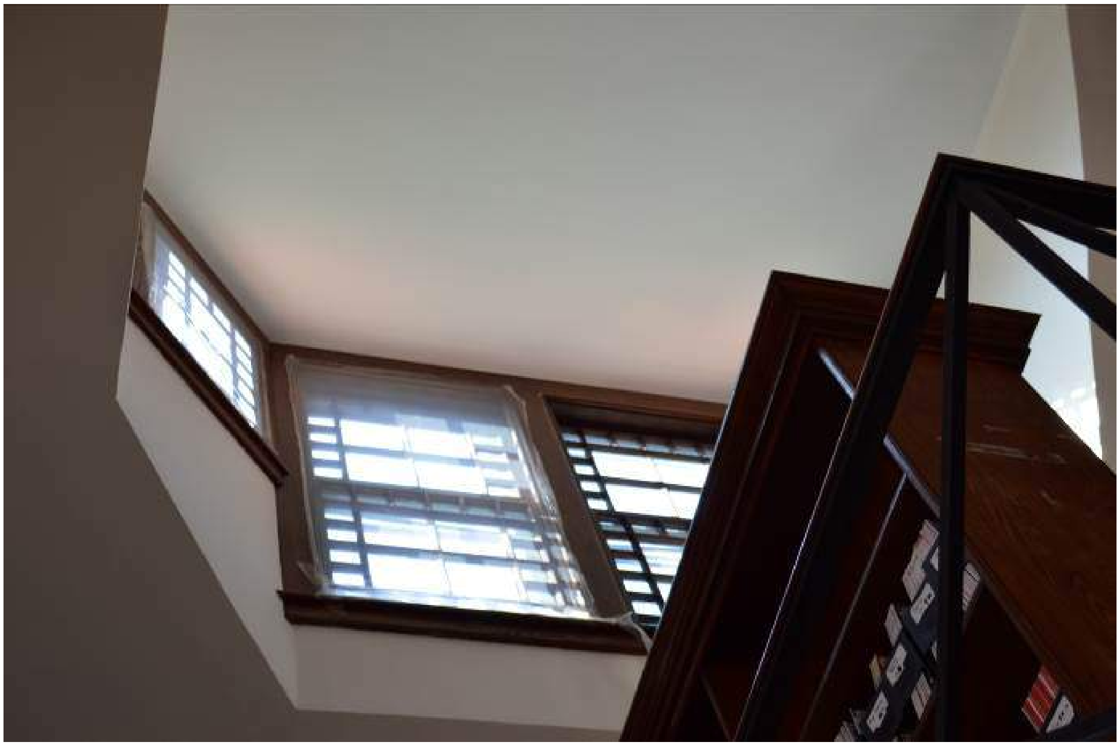

Figure 22 - Interior storm window treatments should be avoided as condensation will occur on the coldest layer, in this case the wood window itself, causing damage to the wood.

- ***ARCHITECTURAL WOODWORK***

  Conditions

  The *architectural woodwork* of the tower, dormers and door and window trim is found to be in fair to poor condition. According to maintenance records, failed paint coatings have been an issue for over a decade. As a result, significant work is necessary to preserve the existing historic fabric and only replace the minimum amount necessary.

  The *architectural woodwork* of the building is characterized by peeling paint. Fascia, soffit, frieze, brackets, panels, moldings and other wood members of the tower, dormers, and door/window surrounds must be scraped, sanded, primed, and painted. All actions that involve the handling of wood must be performed in full compliance with Massachusetts' 'De-leading and Lead-Safe Renovation Regulation,' and the EPA's Renovation, Repair and Painting (RRP) regulations by a licensed, 'Lead Safe Renovator' if testing detects the presence of lead.

Figure 23 - Wood gable elements require repair and repainting.

Recommendations

- Remove paint to bare wood or firm substrate and prepare for paint.
- Repair rather than replace deteriorated wood surfaces whenever possible.
- Where wood replacement is unavoidable, repair in kind with the same material. Azek and similar PVC composite materials are not acceptable according to the Secretary of the Interior's Standards as in kind materials are commercially available. Best practice generally dictates the specification of western red or Spanish cedar. All wooden elements and the butt ends of scarf joints must be primed and painted on all sides before installation. Stainless steel finish screws are the preferred choice for exterior wood details. The second, final coat of paint will be applied to new work and repairs during acceptable weather conditions.

- *Paint color analysis* should be conducted for wood siding, trim, casings, windows, and doors to determine original color scheme. When necessary, all paint must be removed to bare wood because the original oil-based coating has alligatored and is holding moisture against the wood. In order to protect the original historic fabric, the least abrasive method possible must be used for paint removal. Pressure washing and sandblasting are inappropriate methods of removal. After paint removal, apply a high quality oil primer followed by two coats of exterior latex paint.

INTERIOR

- ***ACCESSIBILITY***

  Conditions

  By today's standards, the original building was not accessible to those with physical disabilities. As stated earlier, provisions for universal accessibility compliance were implemented in 1999 and included the installation of an exterior ramp system from the parking area to the lower level. A lift at the lower level was installed to provide access to the first floor and the Children's area that now occupies the Stage to the north. Accessible toilet rooms were also installed on the lower level and were provided on an accessible route. All doors on the accessible route are not provided with lever handle door hardware and closers that meet accessibility code guidelines. Access to primary function areas such as the Children's Activity Room on the lower level is pinched to a width less than required for accessibility due to shelving placed along the edge of the corridor.

  At present the Limited Use/Limited Application (LULA) lift is not operational which renders the main floor and Children's area inaccessible and non-code compliant. The lift equipment is operated by a circuit board that has failed and is no longer manufactured. This is a serious problem that should be a high priority.

Figure 24 - Door hardware along accessible routes should be code compliant for universal access. In this case a level handle lockset is appropriate.

Recommendations

- A new operating system should be installed on the existing lift cab to provide a functional vertical transport.
- Lever handle hardware and door closers adjusted for accessibility should be installed on all doors connecting function areas on the accessible route.
- Remove shelving and other obstructions throughout the building that limit the width of passage to less than 42".

- ***CODE COMPLIANCE***

Conditions

As outlined in Appendix D, Code Review, older buildings designated as historic structures by virtue of listing on the historic register at the state or national level may not be required to fully comply with current building codes. This ruling is helpful to allow Clapp Memorial Library to be exempt from full compliance as many character defining historic features would need to be dismantled, altered or replaced in order to meet the letter of the law. In particular, width of stairs, depth of landings, dimensions of stair risers and treads, and width of egress doors fall into this category.

Beginning from the entrance to the building on the north side, the double doors are each 30" wide. By current code at least one leaf should be 36" wide. There is no panic hardware on the doors. The stairs to the main floor and to the lower level are compliant with current code. Technically the door to the main library services at the top of the stairs should open out to the staircase egress component and it does not.

At the front entrance, there is no interior landing at the base of the stairs. There is only a tread's width beyond the last riser to the lower entrance door where code requires a landing as wide as the staircase itself, in this case twelve feet wide. Due to the location of the lower level egress door at the exterior of the formal front entrance recess, it is not possible to add a lower landing within the vestibule without jeopardizing egress from the lower level.

Particularly on the lower level, means of egress are diminished by furnishings and areas of storage. Technically the corridor connecting the north and west egress doors should be a one hour fire rated system with one hour doors and walls. The corridor should be clear of all obstructions and supply areas should be closed off from the means of egress with fire rated door and wall systems.

Figure 25 - There is no landing at the base of the front entrance stairs leading to a hazardous condition.

Recommendations

- Confer with the local building official to determine if the doors at the north entrance meet egress requirements based on occupancy load and egress capacity. Based on the library's interest in providing a new door configuration with glazed panels in the upper portion of the door for patron safety when exiting the building, it may be possible to install a pair of doors with leaves of unequal widths to accommodate a three foot wide panel in the five foot opening. The hardware on this door should include panic devices and closers.
- Reverse the swing of the door at the top of the stairs into the main library at the north stair hall to swing into the stair hall and incorporate panic hardware.
- Incorporating a landing at the lower west stair is technically infeasible and would alter the historic fabric of the building by eliminating the character defining feature of the recessed arched opening of the main entrance. However, if a new interior vestibule were to be introduced at the top of the stairs, it might be possible to alter the rise and run of the stairs although this would be a major structural alteration. The safest option is to utilize the north entrance to the greatest extent possible.

- While storage capacity for all functions within the library is at a minimum, furniture within corridors should be removed to allow for code required egress minimum widths. Shelving and other items should be removed from the egress corridors particularly on the lower level. The craft storage room should be separated by a fire rated partition from the egress corridor.
- The stair to the Children's Reading Area could be rebuilt adjacent to the stage in a similar configuration with code compliant treads and risers that would result in increased safety to patrons utilizing the stair access.

Figure 26 - Stairs to the Children's Reading Area should be rebuilt to have a code compliant rise and run.

- ***INTERIOR FINISHES***

  Conditions

  Interior finishes are in generally good condition. Floor finishes on the main level and second floor areas are mainly carpeted. Lower level finished rooms including the Children's Activity Room are built up on a raised wood flooring system and also carpeted and in good condition. The lower level spaces allotted to mechanical equipment and book sales are several steps below the finished areas with the floor system composed of slab on grade.

Plaster walls in the main and second floor level are in good condition. There was an area of failure of the plaster ceiling on the south side of the building adjacent to the stained glass window in 2008. This study believes that water infiltration through weakened mortar joints caused the plaster adjacent to the wetted walls to take on moisture resulting in the failure of plaster "keys" resulting in a portion of the ceiling to collapse into the main floor.

A survey of the exposed wood structure including the reading room balconies and decorative trusses found evidence of checking of some of the members. This is a purely aesthetic concern, to be expected of large timber members, and is not a concern as to weight bearing capacity or structural strength.

The decorative wood mesh screen at ceiling level between the main room and the reading area to the east has been reinforced in the past. The screen shows signs of sagging as the wiring connecting the wood elements has stretched over the years. This is not a structural concern but rather an aesthetic issue.

Figure 27 - The decorative screen shows signs of bowing but is not in danger of failure.

Failing plaster ceiling finishes on the lower level are an area of concern as the material has not been tested to determine its composition. Additionally, the plaster ceiling provides fire resistance between the lower level and the main floor which is currently compromised in areas of failure. Moisture infiltration through the building's field stone foundation is most likely the cause of plaster ceiling failure.

Figure 28 - The failing lath and plaster ceiling should be removed and a fire rated ceiling finish installed.

Recommendations

- A budget line item should be included for carpet replacement every ten to fifteen years.
- Exterior repairs to roofing and masonry should be undertaken to insure the moisture does not infiltrate the interior and compromise plaster or wood finishes.
- Interior plaster finishes damaged by water or removal of the "Poetry" window should be repaired to match adjacent surfaces.
- The lower level plaster ceiling should be removed and replaced with fire rated gypsum wall board to provide a fire separation between levels and to eliminate the unpredictable failures in the system.

- ***STAINED GLASS WINDOWS***

Conditions

Julie Sloan of Julie L. Sloan, LLC, Consultants in Stained Glass, performed a conditions assessment of "Poetry", the stained glass window which is the focus of the south wall. Designed by H. Edgar Hartwell and installed in 1886, the window is a memorial to the library's founder John Francis Clapp. Library records show that the window was re-leaded in 1928 with additional re-leading performed in 1993 at which time a protective exterior glazing panel was installed within the existing window frame. In 2010 a portion of the window was repaired due to damage from a partial ceiling collapse.

At present, as the study in Appendix C documents, the window shows signs of stress in the form of bowing of the lower portion of the central lancet. The study concludes that this fatigue is due to a lack of perimeter engagement in the structural framing of the window opening as well as a lack of support bars that were once a part of the stained glass window structure. The protective glazing is unvented which has led to heat build up next to the stained glass panels causing weakening of putty and lead came as well as crazing of the protective glazing itself.

Figure 29 - Inscription on the north window.

Recommendations

Based on the consultant's report, recommendations for restoration and repair of the "Poetry" window include the following.

- The main lancet window should be removed by a qualified restoration specialist and restored to correct bowed portions and to repair broken glass.
- Prior to reinstallation, the window framing should be modified to provide a rabbet that will engage the perimeter of the window.
- Once reinstalled, the window should be further supported on the interior with a full array of saddle bars.
- The exterior window frame should be scraped to bare wood, prepared and painted.
- A new framed ¼" glass panel should be installed in sections relating to the sections of the window itself. The panel should be vented to eliminate heat build-up and condensation.
- At the time of restoration, a stained glass specialist, in concert with an architect, should detail new window jambs to engage the stained glass window and support the protective glazing without detracting from the historic nature of the window opening.
- The north window should protection should be replaced in the same manner as recommended for the south window.
- The lay lite in the ceiling of the main hall should be cleaned, repaired where glass is broken and missing, and a protective glazing installed at the face of the window to insure safety in the event of lead came failure as this is the only window with the original narrow width came remaining.

Figure 30 - The central lay lite is slightly damaged. Protective glazing should be installed on the underside.

- ***STRUCTURAL ASSESSMENT***

Conditions

According to the structural assessment prepared by CME Associates, Inc., which is attached as Exhibit A in the Appendix, the building is in good condition. While extensive load calculations are beyond the scope of this report, quick calculations revealed that the roof, floor and stack framing is adequate for current library use. A summary of the several matters noted as "significant structural issues" follows.

Cracks in the exterior masonry are most likely due to building settlement over time, and seasonal thermal expansion and contraction. Due to the inflexible nature of masonry construction, cracks in the most vulnerable area of the wall i.e., the mortar joints, have appeared around the entire building and are most evident at the corners of the north and south walls. The cracks are not an indication of structural failure.

Shifting of the coping stones on the northeast and south sides of the building has occurred most likely as a result of the freeze/thaw cycle over the course of many years. Water can enter the masonry wall system through the wide, unpointed joints between stones and damage interior finishes as may have been the case on the south wall when a portion of the plaster ceiling collapsed.

A third item of note is water infiltration into the basement as was noted by library personnel. At the time of the site assessment, there was no standing water but there were indications of past puddling. Water infiltration could be the result of a high water table or poor site drainage adjacent to the building.

Strengthening of the stained glass window on the south wall of the building is noted as an area of concern due to the obvious bowing of the window. There is evidence of the removal of past support framing which provided lateral strength against wind loading.

The connections within the King Post trusses that support the cupola are noted as being deficient. This condition is a result of flaws in the original design but it is not seen as requiring emergency repairs. The poorly constructed joint at the base of the truss has previously been noted and monitored without showing further displacement.

Recommendations

The structural engineering report offers the following potential repairs with regard to the areas of concern noted above.

- Re-point areas of the building where mortar is cracked or missing.

- Re-seat the coping stones as necessary and repoint between stones.
- Insure positive drainage away from the building by cleaning gutters, downspouts and underground drains. Install a curtain drain system to capture groundwater if these recommendations fail.
- Reinstall the brace on the south stained glass window to provide strength against wind loading.
- Design and install remedial framing or connections for the cupola truss to insure future stability of the cupola framing.

Figure 31 - A telltale has been installed on the King Post truss in the attic to measure movement of the joint.

- ***MECHANICAL, ELECTRICAL AND PLUMBING ASSESSMENT***

Conditions

An evaluation of existing conditions by Salamone & Associates, PC may be found in the Appendix as Exhibit B. The extensive report is briefly summarized below.

- The sanitary waste system is in good condition and there are no areas of concern with this system. Domestic hot and cold water systems are fed through copper pipes that are visible within the basement ceiling and other exposed areas. The piping is currently uninsulated which is energy inefficient. Plumbing fixtures were overall found to be in good condition with the exception of a non-frost protected exterior hose bib.

- Fuel oil storage and distribution systems were noted to be in good condition with the exception of a missing cap on the exterior fill pipe. The existing furnace appears to be an older model as is the associated burner, both of which are in fair condition and energy inefficient. The air distribution system to the main library is in workable order although there is concern from building occupants that the system is inadequate in heating the main room.

- Electrical meters and panels have been upgraded and meet the demands of the building. The panels are located in the basement in an area used for book storage which impedes code required access to the panels. Wiring and devices throughout the building are for the most part in good condition although specific areas do not meet code with regard to the provision of lighting switches at doorways, and the requirement for a GFI receptacles in the main level toilet room.

- Interior lighting fixtures are varied throughout the building. Most are in good condition with the exception of some of the basement fixtures that are not served by switches, but rather individually controlled. There are many incandescent lighting fixtures throughout the building that are not energy efficient. Exterior lighting appears to be adequate in providing appropriate levels of illumination, but the fixtures are not energy efficient.

- Emergency egress lighting system are for the most part installed per code requirements although several fixtures require adjustment or replacement.

- The Fire Alarm System is a contemporary system which satisfies the needs of the building. Minor adjustments of individual components is warranted.

- Carbon Monoxide Detectors are installed as per code.

- The Telecommunications system wiring appears adequate for current use.

- A Security System based on motion detection and CCTV cameras is installed but could be upgraded to include additional cameras for greater security coverage.

- A snow melting system for the exterior ramp is in place and in working order. Additional roof mounted snow melting cabling is not functioning.

Recommendations

- Plumbing system improvements include insulation of copper domestic water piping to conserve energy. Replacement of lavatories with ADA compliant handles and water saving faucets is also recommended. Piping under sinks should be insulated to protect wheelchair users from injury.

Figure 32 - The heating unit should be replaced, under sink piping should be insulated and dispensers should be mounted at code compliant heights.

- Heating system recommendations include upgrading the existing furnace to achieve energy efficiency and cleaning the existing ductwork. The hydronic heating system is served by an oil fired boiler and circulation pump, both of which have outlived their useful life and should be replaced. Copper piping that circulates the water should be insulated to achieve energy efficiency.

- The thermostat that serves the fan coil unit in the lower elevator lobby should be replaced due to its age and lack of efficiency.

- Hydronic baseboard heaters should be cleaned and enclosures replaced as they are currently missing or in poor condition.

- Electric baseboard radiation should be replaced.

- Furniture should be moved away from all radiation units to allow for proper air circulation.

- Ceiling fans in the main library spaces should be replaced with larger units that are multidirectional and hang lower into the volume of the main spaces. New units should be selected that are consistent with the architectural features of the space.

- Supplemental heating and cooling systems should be added to spaces that are not currently adequately climate controlled including the director's office. A ductless split system in this room would provide heating and cooling through the installation of an interior wall mounted unit. Unfortunately, this unit requires an outdoor compressor which would be unsightly on the front lawn.

- Attic installed air handling units with outdoor compressors at the rear of the building are another option that would provide supplemental heat and cooling to the main library space as well as ancillary spaces. Incorporating supply and return grills in the existing ceiling and moving the air to the level of the users will require detailed design which is beyond the scope of this study.

- The electrical service is in good condition but recommended improvements include providing clearance at the panels as required by code, providing a panel directory where missing on panel MDP and installing a surge protection device on this same panel.

- Recommendations for improvements to the power distribution system and wiring devices include installing covers on open junction boxes, providing additional switching in the Children's Activity Room, installing occupancy sensors in all rooms within the building and installing GFI receptacles in locations required by code. Installation of additional receptacles is recommended to eliminate the possibility of overloading circuits by using power strips.

- Interior lighting should be upgraded to include high efficiency fixtures and lamps. Occupancy sensors in individual spaces should be installed to save energy. Plug-in and pull chain fixtures in the basement should be replaced and rewired into the switched system. Exterior fixtures should be replaced with energy efficient fixtures.

- Emergency lighting systems particularly in the basement level should be adjusted to provide adequate throw. Furnishings should be relocated so as to not impede the fixtures. Battery powered backup is required in the fixture in the Children's Activity Room.

- Recommended improvements to the Fire Alarm System include relocating a manual pull switch closer to the north side entrance door in order to be code compliant. Fire alarm system junction boxes should be painted red to distinguish them from other junction boxes and the conduit should be firmly secured to the building structure in locations where it currently is not.

- Stand-alone Carbon Monoxide Detectors should be integrated into the existing Fire Alarm System.

- The Security System could be upgraded to include additional coverage.

- The snow melting wiring on the main roof adjacent to the exterior access ramp should be replaced as it is nonfunctioning.

6 PRIORITIZED TREATMENT PLAN AND COST ESTIMATE

Prioritization of tasks

It is not an easy task to assign priority levels to the work needed at Clapp Memorial Library. Most work scopes could fall under the 'urgent' or 'immediate' headings, but the schedule below anticipates budget and timing restrictions. The rate at which tasks are undertaken should be accelerated wherever and whenever possible.

Construction Budget

Estimates of cost assume that all work is performed by a DCAM certified contractor at prevailing wage rates in compliance with the Davis-Bacon Act. The estimates include the costs to perform the itemized tasks and 20% for a general contractor's fee. An additional 20% has also been identified to account for the costs of an architect and/or engineer's design services but are not included in the overall costs in this construction budget. Design fees can fluctuate by 5% or more and will tend to be higher if the work is phased over time as opposed to being provided for a single project.

Similarly, each time a contractor mobilizes there will be associated startup costs, and contracting for multiple projects will cost more than a single project. Labor costs have been based on published data in the R.S. Means Guides for commercial construction. Labor rates have been adjusted to the prevailing local wage rates for each task. It should be noted that the Means Guide indicates that a 25% increase in labor pricing should be added for restoration work. Further, there is a scarcity of contractors who are skilled and trained to successfully undertake historic preservation projects, thereby adding to the cost of construction

.

A 10% contingency has been factored in to account for unforeseen conditions that are typically uncovered during the restoration of historic properties. Access costs (i.e., lifts, scaffolding) and markup for overhead and profit are collapsed into the prices below. Material and labor costs are not constant and are subject to uncontrollable economic conditions. Tax rates and workers compensation insurance rates show no sign of decline. The costs projected in this construction budget will increase 3-5% with each passing year.

Cost Estimate

Urgent (0 to 12 months) $108,000

Clay tile roof repairs (p. 23)…	*$24,000 to $32,000*[1]
Replace damaged section of roof drainage system (p. 25)…	*$12,500*
Install and monitor tell-tale gauges in select joints (p. 28)…	*$2,500*
Prep/paint exterior stairway and ramp railings (p. 29)…	*$1,000*
Repair south stained glass window (p. 42)…	*$30,000*
Provide individual heating and cooling of offices (p. 47)…	*$20,000*
Install new boiler pump (p. 47)…	*$1,000*
Replace electric heat in the basement hall (p. 47)…	*$1,000*
Elevator repairs (p. 36)…	*$8,000*

Immediate (1 to 3 years) $165,000

Install perimeter drainage system (p. 22)…	*$50,000*
Repoint and repair façade (p. 27)…	*$17,000*
Reset coping stones and install lead weather stripping (p. 28)…	*$37,000*
Repoint foundation (p. 27)…	*$7,000*
Repair cupola framing (p. 44)…	*$17,000*
Upgrade plumbing fixtures (p. 46)…	*$4,000*
Replace boiler and furnace (p. 47)…	*$25,000*
Replace/repair hydronic baseboard (p. 47)…	*$3,000*
Replace bathroom exhaust/louvers (p. 46)…	*$3,000*
Clean ductwork (p. 47)…	*$2,000*

Mid-Range (4 to 6 years) $160,000

Restore and repair exterior windows (p. 31)…	*$48,000*[2]
Repair dormers, tower and fenestration surrounds (p. 34)…	*$64,000*
Prep and paint exterior trim and woodwork of building (p. 34)…	*$28,000*
Install ADA and improved egress features (p. 38)…	*$20,000*

Long Term (7 to 10 years) $70,000

Replace the asphalt shingle roofing when needed (p. 24)…	*$42,000*
Maintenance budget for roofing, masonry and woodwork (p. 34)…	*$8,000*
Replace carpet (p. 40)…	*$20,000*

Total estimated treatment budget over the next ten years equals $503,000.

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[1] The variable in prices correlates with the availability of tiles for repairs. Unless sufficient stock exists on site, replacement units will need to be purchased from salvage dealers or—worse—custom fabricated.

[2] For budgeting purposes, a window restoration specialist should be contracted to examine the fenestration and prepare a detailed window schedule.

7 CYCLICAL MAINTENANCE PLAN

Maintenance
The most important component of any plan to preserve a historic structure is maintenance. As soon as a building is constructed or rehabilitated, the natural process of deterioration begins. Preservation has been defined as "the act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the on-going maintenance and repair of historic materials and features rather than extensive replacement and new construction."

Regular inspection and maintenance of systems will help preserve the integrity of historic building fabric. If that fabric is maintained, deterioration will be minimized or eliminated. While the decay of components of the envelope cannot be avoided, neglect can actually cause this process to increase at an exponential rate. The use of the wrong materials and methods will often cause worse damage to irreplaceable historic building fabric. Every historic structure, no matter how small, should have a written guide that includes:

> Lists and schedules for periodic inspections of each system. These should be set-up in a 'checklist' format, to ensure uniformity of procedures over time;
> Blank elevations of the building to be marked up during inspections and after any work takes place;
>
> A full set of actual photographs that comprehensively document the conditions of the entire structure as well as a digital copy of each;
>
> An emergency list of contractors who can be called upon in an emergency, especially HVAC, electrician, plumber, and roofer;
>
> Individualized procedures for the historically appropriate handling of the individual systems and materials of the building; and,
>
> Hard copies of completed reports that document all work and inspections. Include copies of estimates, contracts, warranty cards, paint colors, mortar recipes, materials sources, and any other information that will be needed by future stewards of the structure.

When considered in the long term, the cost to maintain historic structures is significantly less than the restoration of historic systems and materials, and it creates far less disruption to building occupants. When a property owner or manager creates a maintenance program for their building, it is strongly recommended that they seek the counsel of a preservation consultant, and/or experienced contractor. The maintenance program should clearly identify and describe courses of action that are specific to the building.

Inspections after a weather event

- Using binoculars inspect the roof for loss of shingles. Replace or repair as required.
- Inspect the attic structure for evidence of water infiltration.
- Inspect the basement for evidence of water infiltration.
- Insure that gutters are not clogged with debris and that leaders are running freely.
- Inspect glazing for breakage. Replace as necessary

Semi-annually

- Remove algae growth from building materials with the gentlest cleaning means possible.
- Inspect caulking and weather stripping at doors and windows. Replace as necessary.
- Inspect gutters and downspouts to insure that they are secured to the structure and are clear of debris and running freely.
- Clean debris from trench drain at ramp.
- Insure that emergency lighting fixtures are working properly.
- Replace lighting fixture lamps as necessary.
- Test Fire Alarm System.

Annually

- Insure that painted finishes are intact and protecting substrates. Touch up paint as required.
- Inspect mortar joints in masonry wall and foundation. Repoint as necessary.
- Inspect chimney and roof flashing. Replace if needed when roof is replaced.
- Inspect exterior wall surfaces for damage caused by moisture or structural stress. Repair as condition warrants.
- Insure that light fixtures, signage and any other building mounted objects are secured to the structure and in good condition.
- Clean and maintain furnace and boiler, pumps and burner.

8 REFERENCES

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9 APPENDICES

EXHIBIT A – STRUCTURAL ANALYSIS

EXHIBIT B – MEP ANALYSIS

EXHIBIT C – STAINED GLASS ANALYSIS

EXHIBIT D – CODE REVIEW

EXHIBIT E – SECRETARY OF THE INTERIOR'S STANDARDS

APPENDIX A
CLAPP MEMORIAL LIBRARY
STRUCTURAL CONDITIONS ASSESSMENT

This purpose of this report is to review the existing condition of the CLAPP Memorial Library located in Belchertown, Massachusetts and to make recommendations for preservation and restoration.

This report does not include a conditions assessment of the masonry and pointing as this is being completed by Olde Mohawk Historic Preservation.

Definition of Terms for this report:

Term	Definition
Joist	Parallel horizontal members that are closely spaced that are used to support floor decking or ceiling decking.
Rafter	Parallel sloped members that are closely spaced that are used to support roof decking
Beam	Horizontal member that supports joists or wall framing above
Post	Vertical member used to support framing above
Pier	Vertical masonry structure used to support framing
Truss	A structure that consists of multiple tension and compression members only, where the members are organized so that the assemblage as a whole behaves as a single object.
King Post Truss	A truss type characterized by two vertical members, and parallel top and bottom members forming a rectangular center portion. The end portions are diagonal forming triangles. This is a common truss type in historic post and beam framed structures.
Pointing	Mortar placed between stones and brick to create a solid unit. Also known as a mortar joint.
Checking	This is a phenomenon of large wood members. It is characterized by longitudinal cracks that run along the member faces. Checking is a result of drying and shrinkage of the wood after fabrication, resulting in cracks. Checking is recognized by design codes and accounted for in allowable load values; therefore normal checking is not considered a structural defect.

EXISTING CONDITIONS OF THE BUILDING

The Clapp Memorial Library building is stone masonry structure with internal timber framing. The stone façade is made up of brownstone laid in an ashlar stone pattern. The timber framing consists of floor joists, beams, rafters, and small trusses in the attic. The flooring is supported by a foundation that is made with stone and brick. It is not known if the foundation is bearing on bedrock, or native soil. We suspect the latter due to signs of past settlement.

The Library was inspected on November 6, 2014. The weather during the inspection was light rain and approximately 45 degrees. For clarity in this report, the west façade of the building will be taken as the façade facing the street.

The following is a general description of the condition of the building. A detailed member-by-member investigation was beyond the scope of this inspection. The intent is to determine the general conditions of the structure for use in making a decision regarding future maintenance and/or rehabilitation. A detailed inspection would be required if a major rehabilitation project were undertaken.

<u>Exterior conditions:</u>

Exterior:

1. There are no expansion joints in the structure, which is not uncommon for a building of this age. The result is that there are numerous small cracks in the mortar joints that are most likely caused by thermal movement. A structure of this size will change length over the course of the year as the temperature changes. Without expansion joints, the masonry will crack.
2. There have been at least two major re-pointing projects completed on the structure. The contractor did a decent job matching the color and shape of the original joints.
3. There are indications that the north and south walls have shifted outward at the top. There are active vertical cracks in the joints near the corners. The cracks are wider at the top than the bottom, which indicates that the top of the walls have shifted outward. It should be noted that this movement is not significant. There are signs of past re-pointing of these cracks. From the ground, it was estimated that the top of the walls have moved outward approximately 3/8" over the lifetime of the structure.
4. The coping stones on the top of the gable ends have many open joints. This could be easily seen from the ground since it was raining during the inspection. Water is penetrating the top joints and flowing out of the side joints. Many of these stones have shifted, most likely due to freezing of water in these joints during cold periods.
5. The control of roof runoff water around the foundation is a concern. There are signs that the gutters overflow, most likely during ice events. Many roof drains are piped into underground piping. It is not known if this pipe is functional at this time. There are also downspouts that outlet near sidewalks, which probably creates an icing condition in the winter.
6. The roof framing appears to be straight and true. There are no signs of sagging. The original tile roof on the rear of the building has been removed and replaced with asphalt shingles.

Interior (main room):

1. The large stained glass window on the south façade shows signs of a past horizontal member that has been removed. These members are typically used to provide structural support for the window framing in order to resist wind loads.
2. The floor framing of sawn joists are in good condition and stable.
3. There are no signs of distress in the framing supporting the balcony book stacks. The stacks are primarily empty at this time. Approximate load capacity calculations were completed as part of this assessment. Based on this, the beams under the stacks appear to be inadequate to support modern stack loading. This analysis was preliminary and did not account for the wainscoting under the supporting beam. Further investigation into the framing of the lower bookshelves and floor system underneath would need to be undertaken in order to determine if the stacks could be re-used for book storage (which is beyond the scope of this investigation).
4. The wood posts supporting the balcony book stacks have checking. The amount of checking is not excessive, therefore this is not a defect.

5. The ornamental lattice work between the main room and the east room has significant bowing. It appears that wires have been added to stabilize this. Based on a review of the roof framing, it appears that this lattice work is not a structural element of the building, therefore this bowing is not a problem.

<u>Interior (attic):</u>

1. The roof is supported by sawn lumber rafters (2"x7½", 18" on center). The rafters are in excellent condition. Approximate load capacity calculations were completed as part of this assessment. Based on this, the rafters are more than adequate to support modern code loads.
2. The support of the framing for the cupola tower is questionable. The cupola has a series of posts that transfer the vertical loads and wind loads to the underlying framing. The east and west posts bear on large wood beams that are framed into the ceiling of the main room. These appear to be functioning well. The north and south posts are supported on King Post Trusses.

   The King Post truss shows signs of significant overstress, primarily in the connection at the top of the posts. The connection has shifted downward approximately ½". This shifting is technically considered a structural failure. There is still capacity in the connection, but it is doubtful that the connection can support modern loads. A previous engineer has placed wood paint stirrers and marked them in order to record changes over time. Based on these marks, it appears that the connection has not moved in the last several years.

   An analysis of this truss was not within the scope of this investigation; however it is obvious that the original connection was defective and inadequate. It should be fairly easy to strengthen this truss with the addition of sister beams near the base. Significant structural calculations would need to be completed in order to determine the snow and wind load forces on the cupola framing.

   This situation has been in place for the entire life of the building; therefore it should not be considered an emergency situation. The nature of the cupola framing is somewhat redundant; therefore there can be significant load redistribution should this connection displace farther. The load would essentially be redistributed to the east and west posts.

<u>Interior (basement):</u>

1. Very little of the floor framing is exposed due to the presence of plaster. Based on what can be seen, it appears that the floor framing is sound. There is no sign of deterioration or distress.
2. Several heavy timber beams are exposed. There are checks in these beams; however it does not appear to be a problem.
3. The posts supporting the floor are made with brick and granite. The posts are in good condition.
4. The basement was dry at the time of the inspection; however there are signs of past water infiltration. There are signs of the installation of an internal floor drainage system, characterized by trenches running across the floor. This may or may not be the case, as the trenches could have been made for utility piping. The foundation walls are made of mortared stone rubble masonry. There is efflorescence (white staining) that is a sign of past water infiltration.

5. A library assistant noted that significant water infiltration has occurred in the past.

SIGNIFICANT STRUCTURAL ISSUES

Several structural issues were identified above. Minor issues that do not require action are not listed. The issues were described above. The following is a description of the most likely cause of each significant issue and potential repairs:

1. **Cracking in Exterior Masonry:**

   a. Most Likely Causes:
   The building has no expansion joints in the masonry, which is common for older masonry structures. All building materials will expand and contract when exposed to temperature variations. Modern buildings have vertical expansion joints spaced at approximately 25 feet on center that allow for expansion and contraction.

   Another potential cause of some of the cracking near the corners is minor settlement of the foundations, which could lead to leaning of the walls. This would be characterized by variable width cracks near the corners. This is the case at the Clapp Memorial Library. There are signs of past re-pointing work where the top joints are 3/8" to ½" wider at the top than the bottom. The amount of overall leaning is not significant at this time. The structure appears to be stable.

   b. Potential Repairs:
   Installation of modern expansion joints is not recommended, since it would detract significantly from the historic appearance of the building. Re-pointing of the cracked joints at intervals of approximately 15 years is probably the best approach for this problem. This can be done when the cracks become large enough to allow significant water penetration (more than 1/16"). The leaning of the walls can be monitored by comparing the mortar joints at the top and bottom of the wall. Settlement of foundations is expected unless the foundation is set on bedrock. It is doubtful that the structure will ever become unstable, since settlement tends to subside over the years. The foundations can be underpinned at a great cost, which is not justified based on the current condition. It may take another 75 years before any foundation strengthening is required, and it may never be required.

2. **Shifting of Coping Stones:**

   a. Most Likely Cause:
   The shifting of the coping stones is most likely due to water infiltration in the vertical joints. If the joint opens, water can penetrate and freeze during winter months. Freezing water expands and exerts tremendous force on the adjacent elements. This will either move the elements or break them. If they move, the joints become wider and let even more water in, and the process repeats. Over the years, stone can shift several inches.

   Open joints in the coping stone can lead to other significant problems. The recent failure of the ceiling plaster can possibly be attributed to moisture entering the building interior through these joints.

b. Potential Repairs:
   Stones that have not been shifted significantly can be re-pointed. A flexible joint sealer such as silicone may be justified if the color can be matched as to not detract from the structure appearance. Stones that have shifted significantly may need to be reset. The majority of the stones do not need resetting at this time. Several near the northeast portion of the building probably need resetting.

3. Basement Flooding:

a. Most Likely Cause:
   There are two potential causes of the basement flooding. The first is the infiltration of ground water. This appears to be unlikely, since there is low ground to the rear of the building. The front yard of the building is very flat, therefore this potential cause cannot be ruled out. High water tables can lead to infiltration of water through cracks in the foundation and basement floor.

   The second potential cause is the control of downspout water. The existing downspouts run off onto the ground or are piped into an underground system. The draining of downspout water to the surface can lead to high water tables in the ground. The underground systems can easily be clogged with leaves and debris from the roof, which would also lead to a high water table.

b. Potential Repairs:
   The best (and most expensive) repair is to install a full height foundation curtain drain system. This would require excavation of the exterior foundation walls, sealing and repairing mortar joints, the application of a seal coating and the installation of perforated drain pipes. The pipes should be wrapped in filter fabric to prevent soil from clogging the pipes. This system should be combined with a separate new underground downspout drainage system placed at a higher level (several feet below ground). This system should include cleanout wyes that can be maintained on a regular basis (every 5 years). This repair option is very expensive and would require significant excavation and replacement of portions of the sidewalks and driveways. The drain pipes could possibly be outlet in the adjacent low areas, provided that they are within the property limits.

   If budgets do not permit the best repair, other approaches can be taken. The upper downspout system could be installed on the west, east, and south sides of the building. The north side has a paved parking area that should divert water safely away from the basement. Another less desirable approach is to install interior drains to intercept the water as it get through the foundation walls. The water can be piped or pumped to the low area in the rear.

4. Strengthening of South Stained Glass Window

a. Potential Repairs:
   The brace that was removed should be re-installed. There is potential for the entire window frame to fail in a high wind event. Historical photos may document what was previously in place. If not, a simple steel rod and turnbuckle system can be designed and installed. It will result in a minor interference with the window view; however it would represent a re-establishment of the original structure.

5. Partially Failed King Post Truss under the Cupola:

a. Most Likely Cause:
   The failure of the King Post trusses appears to be an inherent flaw in the original design. The connection of the diagonal truss member to the horizontal truss member is only made with several large toe nails. This is simply not adequate to resist the forces acting on the joint.

b. Potential Repairs:
   There are several potential repairs for this problem. The truss can be removed and replaced with a truss that is properly designed. This is not recommended because it will destroy some of the original fabric of the building and be very expensive and intrusive. The connection can be strengthened with steel plates, which is less intrusive, but difficult to design and execute. The third potential repair would be to install two beams alongside the truss near its base (sister beams). Modern laminated wood beams could be used that could be bolted to the adjacent truss members. This would not look historic; however it would not be visible to visitors, and it would maintain the historic fabric of the building.

Structural Inspection Photos

The following pages contain photographs of structural aspects of the library.
Reference is made to these photos in the structural report.

Photo 1: West Facade

Photo 2: South West Corner
Note mortar joint that is slightly lighter in color and wider than adjacent joints
(sign of past repairs due to minor wall movement)

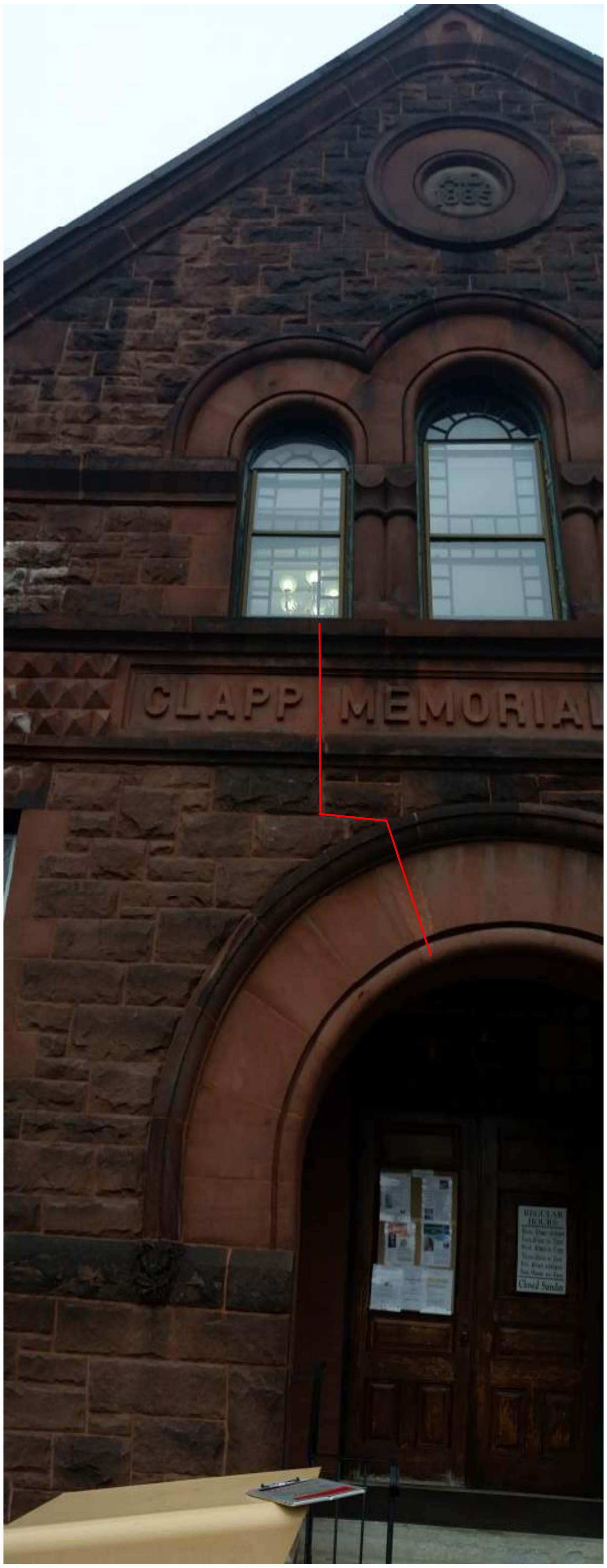

Photo 3: West Façade
Note: Thermal expansion cracking in arch stones, progressing vertically upward.
Cracking progresses diagonally up to coping stones.

Photo 4: South Interior Corner Near Front Entrance
Note past joint repairs on interior corner (sign of past expansion crack repairs)

Photos 5&6: South Façade
Note water weeping from coping stone joints

Photo 7: East Façade

Note Past displacement of coping stones

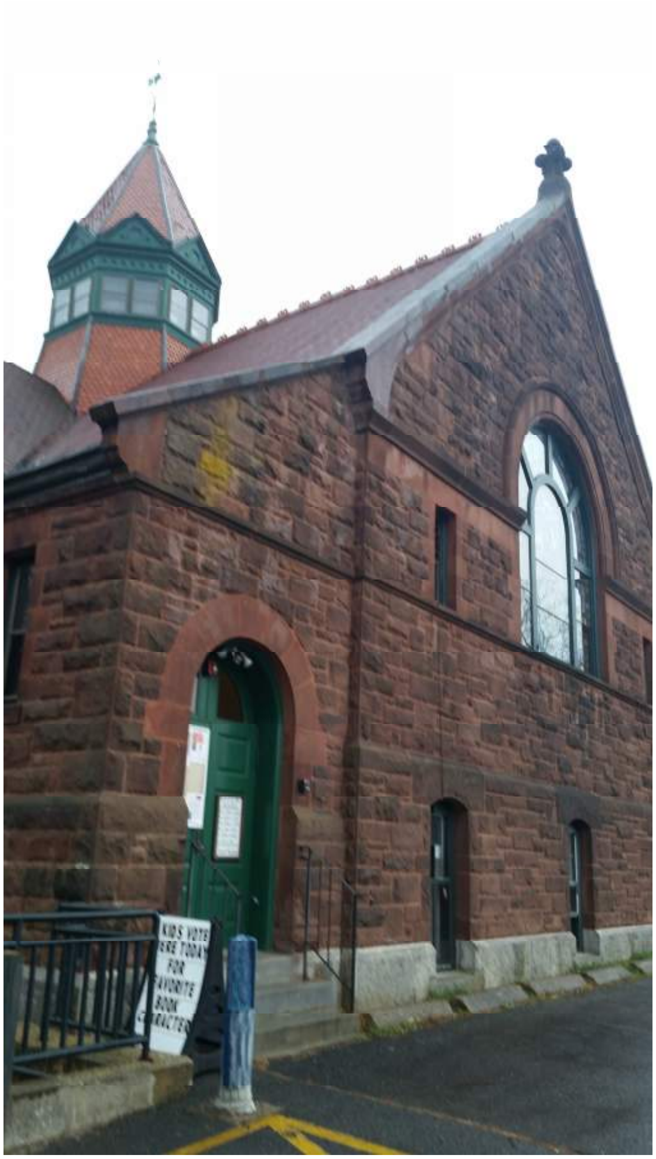

Photo 8: North Façade

Photo 9: South Stained Glass Window
Note Missing brace member

Photo 10: Overall Interior Space

Photos 11&12: Framing Supporting Balcony

Beam noted by red arrows
Post noted by blue arrow

Photo 13: Typical Condition of King Post Trusses Supporting Cupola Post

Note vertical shifting of top horizontal member and gap measuring device

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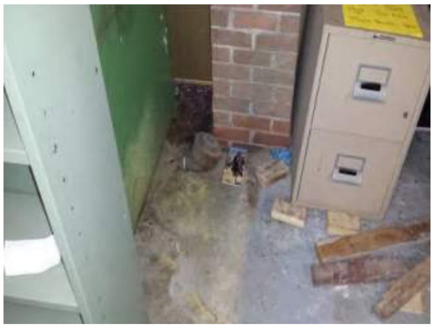
APPENDIX B

EXISTING PLUMBING, MECHANICAL AND ELECTRICAL EVALUATION

Sanitary Waste System:



Located within the boiler room slab, the sanitary piping system is routed to the bathroom plumbing fixtures. A floor cleanout was found adjacent to the furnace in the lower level. The majority of the piping appeared to be painted white cast iron in the corridors with some areas being replaced with copper.

The sanitary system appeared to be in good condition with no signs of leakage or deterioration.

Domestic Cold Water System:

The domestic cold water piping enters the basement and is routed to a water meter. The main pipe has an isolation valve and is routed to the plumbing fixtures located throughout the building. The piping is not insulated and appeared to be in good condition with no signs of deterioration/leakage. The isolation valve appeared to be in fair condition.

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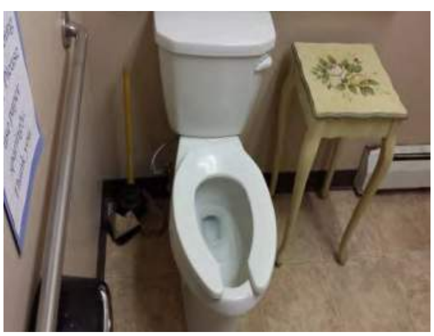
Domestic Hot Water System:

The domestic hot water is provided by an internal coil off the hydronic boiler. Hot water is provided to the bathroom sinks via copper piping routed at the ceilings. All the domestic hot water piping is not insulated and appeared to be in good condition with no deterioration/leaks.

Plumbing Fixtures:

An exterior hose bibb was observed in the front of the library located within a window frame. Piping to the fixture is not insulated and is located in front of the window. The hose bibb and piping appeared to be in good condition.



The basement bathroom located adjacent to the ADA ramp has a water closet manufactured by the Gerber Company and provides 1.28 gallons per flush. The domestic cold water piping to the fixture appeared to be recently installed and is in good condition. The water closet and associated accessories appeared to be in good condition.

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The basement bathroom located adjacent to the ADA ramp has a wall mounted lavatory and faucet. The drain cover/faucet appear to have some deterioration and the basin appeared to be in good condition. The domestic hot/cold piping underneath the fixture is partially insulated and appeared to be in good condition.

The basement bathroom adjacent to the Children's Activity Room has a water closet manufactured by the Eljer Company and provides 1.6 gallons per flush. The domestic cold water piping, water closet and associated accessories appeared to be in good condition.

The basement bathroom adjacent to the Children's Activity Room has a wall mounted lavatory and faucet. The drain cover/faucet appear to have some deterioration and the basin appeared to be in fair condition. Paint was found on the front and sides of the lavatory. Piping underneath the fixture appeared to be in good condition.

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The main level side entrance area has a small bathroom equipped with a floor mounted lavatory and faucet. The fixture appears to have been recently installed and in good condition.

The small main level bathroom has a water closet manufactured by the Kohler Company and provides 1.25 gallons per flush. The fixture, piping and associated accessories appear to be recently installed and in good condition.

Fuel Oil System:

Two (2) above ground #2 fuel oil tanks were observed in the boiler room. Each tank has a capacity of two hundred and seventy five (275) gallons and are manufactured by the Granby Company. The fuel oil tanks appear to be in good condition with minor deterioration present on the enclosures.

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The fuel oil supply lines to and from the boiler and forced hot air furnace are routed in a trench that was recently installed. The lines and filters appear to be newer and in good condition.

Each fuel oil tank has a separate fill and vent pipe located at the front of the library's exterior. The piping appeared to be in good condition with one of the caps missing (covered by a piece of clay).

Forced Hot Air System:

An oil-fired furnace is located in the boiler room and is manufactured by the Waterbury Company. The unit appears to be from the 1950's and has a side filter box with two (2) 16x25 pleated filters. The unit did not have any information regarding capacity and appeared to be in fair condition.

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The furnace has an oil fired burner manufactured by the Carlin Company model CRD. The burner provides a firing range of 2.00-5.00 gallons per hour, appeared to be over twenty (20) years old and is in fair condition.

Breeching for the furnace is routed to the chimney stack located in the rear of the library. A barometric damper located on the breeching provides the required draft. The breeching appeared to be in good condition with deterioration at the connection flange.

Ductwork distribution located within the boiler room is a mix of round and rectangular. Two large ducts feed the main level with one large round return. Several smaller ducts serve storage rooms and miscellaneous areas. All the ductwork is visible as it is not insulated and appears to be in good condition.

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The main level has two (2) floor mounted supply grilles that are served by the furnace. Each grille has different dimensions; 40"x29" and 40"x44". The grilles appear to be in good condition with no deterioration present.

A large floor return grille is located on the main level in the stack area. The grille is connected via ductwork to the oil-fired furnace. The grill measures 60"x 40" and appears to be in fair condition with no deterioration present.

A wall mounted programmable thermostat manufactured by the Lux Company controls the oil-fired furnace. The unit is located on the main level near a supply grille and appears to be in good condition.

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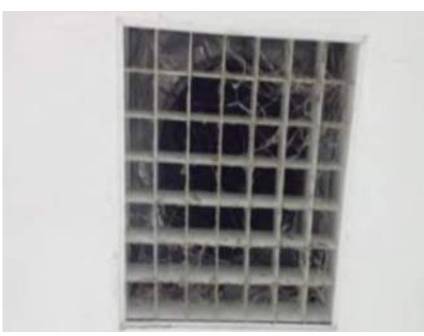
Exhaust Systems:

A wall mounted exhaust fan was found in the storage area of the boiler room. The area was not accessible due to the items in storage.

The main level bathroom has a ceiling mounted exhaust fan controlled by the local light switch. The fan appeared to be recently installed and in good condition.



The basement bathrooms have above ceiling exhaust fans and 8"x8" grilles in the ceiling grid. The fans are controlled by a local light switch and appeared to be in good condition. Debris was found in the ceiling grilles and related ductwork.

Located at the front of the library a 23"x28" louver is used for bathroom exhaust. The louver has major deterioration and debris is located between the damper blades. The overall condition of the louver is poor.

Above the ADA ramp, a hooded wall cap for a bathroom exhaust fan is found. The cap appeared to be in good condition with no deterioration or debris found.

The elevator machine room has a thermostatically controlled louver/damper. The components of this system appeared to be recently installed and in good condition.

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Hydronic System:

A hot water oil-fired boiler manufactured by the Smith Company is located in the boiler room. The boiler provides hot water to the three zones that consist of baseboard radiation and a fan coil unit. The boiler has an output rating of 98 MBH and also provides domestic hot water via an integral coil. Installed in 2003 the boiler appears to be in fair condition with deterioration present throughout.

The oil-fired burner for the boiler is manufactured by the Carlin Company model EZ-1HP and is rated for .50 -1.65 gallons per hour. Overall the burner components appeared to be in good condition.

The hot water is distributed via an inline circulator pump manufactured by the Taco Company model 007-F5. The pump appeared to be in poor condition with major deterioration observed at the flanges.

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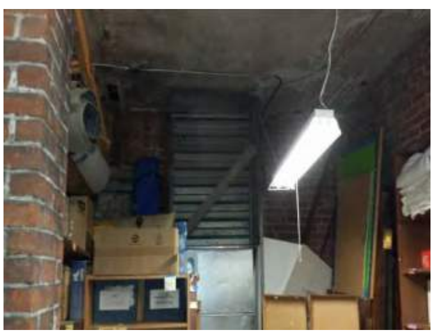
Three zone valves are located above the boiler and are interconnected to the thermostats serving the zones. The wiring appeared to be lose and excessive but not an area of concern.

Piping for the hot water system mainly consists of copper with PEX piping for one (1) zone. No piping insulation was found throughout the building. The hydronic accessories included an expansion tank, breeching, pressure reducing valve and air vent. All the piping and accessories appeared to be in good condition.



Combustion air for the furnace and boiler is provided by an exterior louver and motorized damper located within the boiler room. The motorize damper is interlocked to the burners and appeared to be in good condition.

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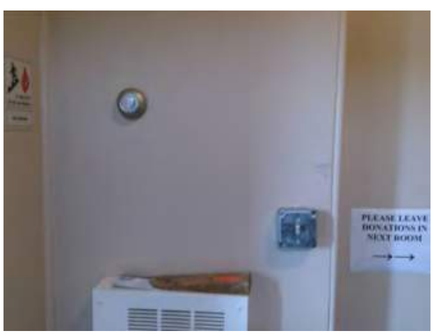
Exterior louver for the combustion air's motorized damper is located at the rear of the library. The louver dimensions measured 38"x 49" with a 2" frame and fixed blades. Some minor deterioration was found on the damper blades, overall the louver was in fair condition.

A fan forced fan coil unit is located near the ADA entrance. The unit is manufactured by the Turbonics Company, model 11/13 WM, and is supplied by hot water from the boiler. The unit is operational and appeared to be in good condition.



A wall mounted thermostat manufactured by the Honeywell Company model T87 controls the fan coil unit via relay in boiler room. The thermostat appeared to be over twenty (20) years old and in fair condition.

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The basement bathroom adjacent to the ADA entrance has 39" of hydronic baseboard radiation. Debris and deterioration was present on the enclosure and it appeared to be in poor condition.

Baseboard radiation is also present in the elevator machine room, Children's Activity Room and corridor. The fin tube appeared to be in good condition while the enclosure appeared to be in fair condition with debris and deterioration

A wall mounted thermostat manufactured by the Ritetemp Company controls the valve and associated relay in the boiler room. A second thermostat of the same type can be found in the main level office area. The thermostats appeared to be over ten (10) years old and in good condition.

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The bathroom located next to the Children's Activity Room has baseboard radiation located behind the door. The enclosure appears to have damage and debris. The unit appears to be in poor condition.

The main level office area has a free standing cast iron radiator located behind storage cabinets. An isolation valve and air vent are located on the supply piping to the unit. The radiator appeared to be in fair condition.

Electric Heat:

A basement storage room has a 48" electric baseboard radiation unit. The enclosure has major deterioration and the unit appeared to be in poor condition.

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Electric baseboard radiation was found a main level office. The unit appeared to be in fair condition with no deterioration present.

Fan System:

Several paddle type ceiling fans are located at the main level ceiling. The fans appeared to have debris on the paddles and in fair condition.

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Electrical Service/Distribution Systems:

The electrical service for the building is provided via an overhead aerial service drop from a utility pole located on the opposite side of South Main Street. The service drop is routed to a second utility pole located in the southwest corner of the property and then continues to the weather head and Class 320 meter socket located on the southwest corner of the building.

Service wiring and conduit then enters into the basement of the building via an interior trough and terminates at a 400 A service entrance (SE) rated circuit breaker disconnect switch manufactured by Square D.

Voltage configuration to the building is 120/208V, 3 phase, 4-wire with an amperage (A) rating of 400A.

The electrical service for the building has been upgraded within the past three years and is in very good condition.

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Electrical distribution within the building is provided by five (5) electrical panels located in the basement. The main distribution panel (MDP) is a 400A, 120/208V, 3 phase, 4 wire, main lug only (MLO) panelboard located on the west wall of the basement a few feet away from the 400A SE disconnect switch, Wiring is routed from the 400A SE disconnect to panel MDP via a 6” x 6” wireway. Panel MDP provides power to the other four (4) electrical panels within the basement.

Adjacent to panelboard MDP is panelboard PB-1. This is a 225A, 120/208V, 3 phase, 4 wire, MLO panel. This panel provides power to the elevator and receptacles within the building as well as to the handicapped door operator and exhaust fans.

Panel LC-1 is located adjacent to the 400A SE disconnect switch. This panel is a 100A, 120/208V, 1 phase, 3-wire MLO load center type panel. The panel directory was missing for this panel but it would seem that this panel provides power to receptacles, lighting and mechanical equipment.

Panel LC-2 is located adjacent to the basement emergency exit doorway. This panel is also a 100A, 120/208V, 1 phase, 3-wire MLO load center type panel. This panel provides power for receptacles, lighting, bathroom heat and hot water furnace.

Panel LC-3 is located in the basement corridor. This panel is a 100A, 120/208V, 3 phase, 4 wire MLO load center type panel and is dedicated to serving the snow melt system for the handicap entry into the building. This panel’s cover has had a keyed lock installed to prevent unauthorized personnel from opening it as it is located in a public area.

All the panels seem to have been replaced when the electrical service was upgraded and are in very good condition. However, with the exception of panel MDP, items have been

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placed in front of the other panels in spite of warning labels advising to keep the area clear. The panels no longer have the minimum three (3) foot clearance required by current code. All items within the three (3) foot area in front of the respective panels should be relocated to allow unobstructed access required by current code.

A surge protection device should be installed for panel MDP at a minimum to reduce potential damage to building equipment, computer systems and lighting during utility company power surges and/or lightning.

Branch Circuit Wiring:

Branch circuit wiring and conduit was primarily observed to be building wiring routed in rigid metal conduit or flexible metal conduit. Surface raceway (Wiremold) was also observed. In addition, a small amount of non-metallic sheathed cable (Romex) was observed.

A ceiling mounted junction box in the basement hallway had the cover unscrewed thereby exposing the live wiring. Cover should be installed correctly.

A few junction and outlet boxes have missing knockouts. Knockout caps should be installed for junction and outlet boxes missing them.

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The fused disconnect for the building's hot air furnace is antiquated. Although it is in fair condition for its age, the disconnect should be removed and replaced as part of any upgrade to the hot air furnace.

Wiring Devices:

Wiring devices consisted of receptacles, switches and occupancy sensors. Duplex receptacles were located throughout the building. However, a number of power strips appeared to be in use. GFCI duplex receptacles were located in the restrooms with the exception of the restroom located on the main floor. No receptacle was located within this restroom. One (1) GFCI duplex receptacle was located on the exterior of the building near the handicapped entry. This receptacle is controlled by a switch located in the basement corridor.

Control of the lighting was provided by single and three way lighting switches. A wall occupancy sensor switch was located within the restroom adjacent to the Children's Activity Room. However, this occupancy sensor did not appear to be functioning properly.

Only one switch was located in the Children's Activity Room. However, the room contains two (2) entry doors.

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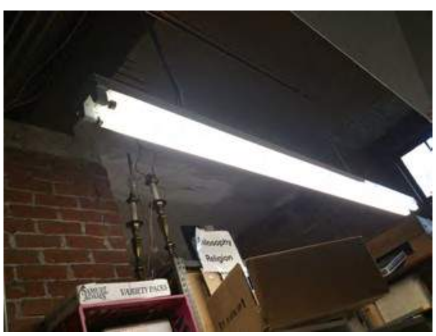
The majority of the existing receptacles and switches observed appeared to be in place a number of years and in fair condition. An additional switch should be added at the second doorway of the Children's Activity Room. The existing occupancy sensor within the restroom adjacent to the Children's Activity Room should be removed and replaced.
Additional occupancy sensors should be located in the other restrooms and offices within the building. A GFCI receptacle should be installed in the restroom located on the main level. Additional receptacles should be installed to eliminate or at least minimize the use of power strips.

Interior Lighting Systems:

A mixture of light fixtures was observed within the building. On the basement level, lighting consisted of ceiling mounted incandescent light fixture in the handicapped entry lobby, recessed 2'x4' fluorescent light fixture with T8 lamps in the restrooms, pendant mounted 1'x4' in the Children's Activity Room and hallways. A 1'x8' fluorescent fixture was also observed in the hallway as well. These light fixtures were controlled by single pole and three way switches.



Lighting within the boiler room consisted of pendant mounted slim width 8 foot fluorescent fixtures controlled by light switches. Also observed were pendant mounted 1'x4' fluorescent fixtures controlled by pull chains, chain suspended 1'x4 fluorescent fixtures with plugin cords and ceiling mounted porcelain sockets with pull chains.

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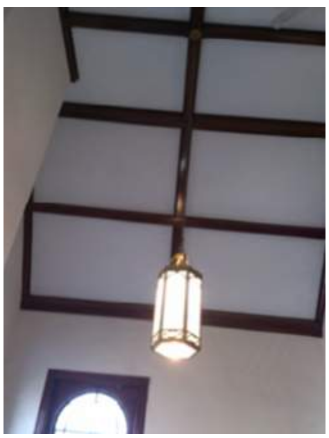
Main floor lighting was provided by ceiling mounted incandescent light fixtures in the main and side entrances as well as the restroom. An incandescent wall sconce was observed in the side entry as well. These fixtures are controlled by wall switches.

General illumination for the main floor is provided by decorative suspended incandescent fixtures utilizing flood type lamping.



Additional lighting within the Children's Area is provided by surface mounted 2'x4' fluorescent fixtures and 1'x4' fluorescent strip lights mounted within wooded framing at the book stacks.

The book stacks at the southern end of the main floor also contain 1'x4' fluorescent strip lights mounted within wooded framing. Power is routed to the stack light fixtures via non-metallic cabling enclosed within wiremold surface raceway routed up from the basement to a junction box on top of the respective stack.

Lighting in the book case coves was provided by ceiling mounted slim profile 4 foot fluorescent strip light fixtures mounted to the underside of the floor beams for the second level.

Tracking lighting is situated above the main entry doorway of the building.

Office areas contained ceiling mounted 1'x4' fluorescent light fixtures was the exception of the office adjacent to the Children's Area. Lighting in this office is provided by wall mounted track lighting located at each end of the office.

In addition to lighting noted above, a three head flood light type fixture was located at the stairway to the upper book case level on the west side and a single flood light type

fixture was located at the elevator door on the Children's Area level.

Upper floor office lighting is provided by a five (5) lamp chandelier and two (2) incandescent wall sconces controlled by wall switches. A wall sconce provided illumination for the stairway.

No lighting was observed in the attic spaces.

The condition and age of the light fixtures in the basement varied. The slim width 8 foot fluorescent fixtures were in good condition and should remain and be reused. Pendant mounted pull chain type 1'x4' fixtures should be removed and replaced with the circuiting rewired so that the fixtures are controlled by light switches. Plugin type suspended fixtures shall also be removed and replaced with hardwired fixtures controlled by light switches. The recessed 2'x4' light fixture on the handicapped entry lobby restroom in the basement was missing its lens. A new lens should be installed.

Children's Activity Room and hallway lighting should be removed and replaced with more energy efficient fixtures.

On the main floor and upper level, the lighting should be removed and replaced with more energy efficient fixtures with additional fixtures added to provide higher illumination levels.

Exterior Lighting Systems:

Exterior lighting consists of one (1) pendant mounted incandescent and one (1) surface mounted incandescent light fixtures at the main entrance. Flood lights controlled by motion sensors were located at the northwest corner, south west corner, side entry door and east side of the building.

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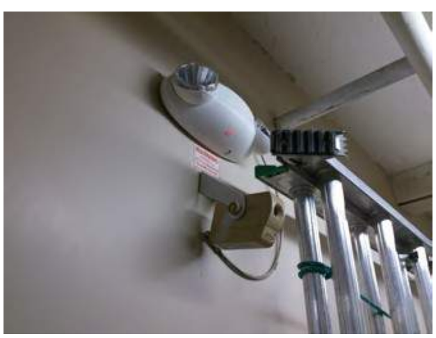
A site pole flood light illuminates the handicapped entry ramp. This fixture appears to be controlled by a building mounted photocell sensor. A recessed light fixture was also observed in the handicapped entry overhang canopy.

With exception of the pole mounted flood light which is in good condition, the exterior lighting is in fair to poor condition and should be removed and replaced with energy efficient fixtures.

Emergency and Egress Lighting Systems:



It appears that emergency lighting within the building is provided by dual head emergency lighting units with battery backup. The emergency lighting units appeared to be in good condition and functional with exception of the combination emergency lighting/exit sign unit in the boiler room. One lamp on this unit was non-functional. The lamps of the unit in the basement corridor are not orientated correctly and the location of the ladder is blocking proper illumination of the area. The installation of additional units would be required to meet current code requirements.

Egress lighting consisted of exit signs with battery backup. The existing exit signs were functional and in good condition. However, the exit sign the Children's Activity room in the basement appeared to be AC only. No remote battery pack units were observed. The exit signs seemed to be

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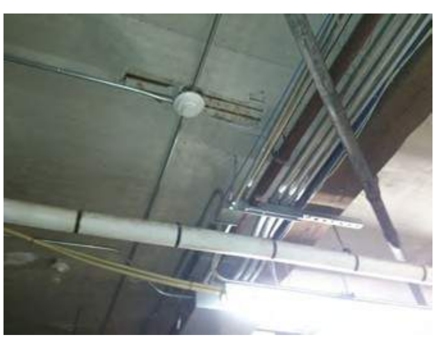
located in accordance with current code and in good overall condition.

Fire Alarm Systems:

The fire alarm for the building is provided by a conventional system. The fire alarm control panel (FACP) located in the basement boiler room adjacent to panel LC-1. The FACP is a Bosch FPD 7024 which contains four (4) detection/initiation zones and two (2) notification circuits. The FACP contains network interface module and two (2) phone lines for central station monitoring as required per Code.

As the FACP is located in the basement, a fire alarm annunciator panel (FAAP) is located at the side entry doorway for fire department use.

Detection devices consisted of conventional smoke detectors located throughout the building. Heat detection devices were observed in the restrooms and the attic.



Initiation devices consisted primarily of single action manual pull stations and one (1) dual action pull station. The manual pull stations are located as required by current code with the exception of the side door. The manual pull station is further than the code required five (5) feet.

Notification devices consisted of horn/strobes located throughout the building.

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It appears as the fire alarm system has been upgraded in the last few years with a new FACP, FAAP and notification devices installed. The smoke detectors are a mixture of different models. Therefore it is assumed as some were added or defective ones replaced when the fire alarm system was upgraded. The heat detectors also varied in age and type. The manual pull stations were not upgraded and have been in place a number of years. They seemed to be in good condition for their age.

Junction boxes for the fire alarm system wiring have not been properly identified with red paint as is standard in some instances. A fire alarm junction box and associated conduit is not securely fastened to the ceiling in the basement hallway and is hanging down somewhat.

The existing fire alarm system should remain and be reused. Existing devices should be replaced as they become defective until the fire alarm system is upgraded again. At that point the entire system inclusive of all devices should be replaced thereby eliminating a mixture of device models and defining the age of the system. A manual pull station should also be installed closer to the side entry doorway to comply with code as part of the future upgrade.

The existing fire alarm system junction boxes should be painted red to identify them and the conduit in the basement hallway properly secured to the building.

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Carbon Monoxide Systems:

Also observed during the field visit were stand-alone carbon monoxide detectors. These were located in the basement boiler room, Children's Activity Room and hallway.

Consideration should be given to installing carbon monoxide detectors which are monitored by the existing fire alarm system.

Telecommunication Systems:

Telecommunications wiring is routed to the building via overhead cabling utilizing the same utility poles as the electrical service. The cabling is routed down the exterior of the building at the Southwest corner and enters into the basement and terminates at the demarcation point located adjacent to panel PB-1.

Telephone outlets were observed in the basement boiler room and Children's Activity room. Tele/data outlets were located on the main level computer stations, circulation desk and office areas as well as the upper level.

The network server for the building is located on the upper level in a wall mounted rack.

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Security Systems:

A security system was observed within the building. Detection appears to be provided by motion sensors located in the basement and main levels. Control panel was located in the main level office.

Two (2) CCTV fixed position cameras were also observed. One (1) is located in the basement hallway observing the boiler room doorway and the second is located on the main level observing the circulation desk.

A third CCTV camera was also located in the basement hallway across from the Children's Activity Room. However this camera did not appear to be connected and was antiquated.

Consideration should be given to upgrading the CCTV system to provide additional coverage.

Snow Melting Systems:

An embedded electric snow melting system manufactured by Delta Therm has been installed for the handicapped access ramp. The system is broken up into three (3) zones. The snow melting system's control panel and associated zone disconnects and contactor relays are located on the East wall in the basement corridor. Power is provide by panel LC-3 located on the adjacent wall.

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In addition to this snow melting system, a plugin type snow melting cable is installed on the roof area above the handicapped entrance. This system plugs into an exterior GFCI receptacle located near the handicapped ramp and is controlled by a time clock and switch on the interior of the building. The time clock and switch are located above the ramp snow melting system. Our office was advised during our visit that the roof snow melting system is no longer functional as the cable at the roof level had been accidentally cut.

The existing roof snow melting cable should be removed and replaced.

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PLUMBING SYSTEM DESIGN CONCEPT:

Proposed Plumbing System:

The majority of the components that are part of the plumbing system appear to be in good condition. Our office recommends removing the following plumbing fixtures and miscellaneous piping.

Replace existing basement lavatory fixtures and faucets.

Insulate domestic water piping.

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MECHANICAL SYSTEM DESIGN CONCEPT:

Proposed Mechanical System:

The majority of the components that are part of the mechanical system appear to be in fair condition. Given the useful service life of this equipment and current condition, cost of service and replacement parts along with labor to maintain the units it could become cost prohibitive to sustain the system. Energy savings will be present with the introduction of proposed components due to the current concern for energy savings and operations. Our office recommends removing and replacing the following mechanical units and associated components in addition to supplementing the existing system in individual offices.

Replace furnace, oil burner and associated accessories.

Replace boiler, circulator pump and associated accessories.

Clean supply/return/exhaust ductwork and associated grilles.

Replace exterior louvers.

Replace electric baseboard radiation.

Replace bathroom hydronic radiation.

Install supplemental heating in individual office areas.

Provide a cooling system(s) for the main and upper levels.

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ELECTRICAL SYSTEM DESIGN CONCEPT:

Proposed Electrical System:

The existing exterior lighting with the exception of a pole mounted flood light should be removed and replaced. The majority of the interior lighting should also be removed and replaced with more energy efficient fixtures with additional light fixtures added. Additional receptacles should be installed to minimize the use of power strips. A surge protection device should be installed within the main electrical panel to minimize potential damage to electrical equipment and components during power surges or lightning strikes. A GFCI receptacle should be installed in main level restroom. Occupancy sensors switches should be installed in restrooms and office areas. Additional emergency lighting devices should be added to comply with current code. Consideration should be given to augmenting the CCTV system.

Our office recommends the following proposed Electrical System:

Provide additional emergency and egress lighting to comply with code.

Provide surge protect devices for electrical panel MDP.

Upgrade carbon monoxide detectors and interconnect with existing fire alarm system.

Replace the existing exterior light fixtures with energy efficient fixtures.

Replace the roof snow melting cable.

Install additional receptacles to minimize use of power strips.

Replace the majority of interior light fixtures with more energy efficient fixtures and the addition of fixtures to increase illumination levels in certain areas.

Replace existing light switches with occupancy sensors in restrooms and offices.

Upgrade of existing CCTV system for building.

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ESTIMATED DESIGN COSTS

*Does not include hazardous materials

Proposed Plumbing System:

- Demolition of the existing plumbing fixtures: $200.00
- Proposed plumbing fixtures and related piping: $800.00
- Proposed pipe insulation: $1,500.00
- Add mixing valve for domestic hot water: $300.00
- Subtotal: $2,800.00
- 10% Overhead: $280.00
- Subtotal: $3,080.00
- 10% Profit: $308.00
- Total: $3,388.00
- Say: $3,500.00

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Proposed Mechanical System:

• Demolition of the existing furnace:	$2,000.00
• Demolition of the existing boiler:	$1,000.00
• Demolition of louvers:	$300.00
• Demolition of baseboard radiation:	$500.00
• Proposed oil furnace:	$8,000.00
• Proposed oil high efficiency boiler:	$10,000.00
• Proposed louvers:	$1,800.00
• Proposed duct cleaning:	$2,000.00
• Proposed baseboard radiation:	$2,000.00
• Individual split duct heating/cooling systems	$20,000.00
• Subtotal:	$47,600.00
• 10% Overhead:	$4,760.00
• Subtotal:	$52,560.00
• 10% Profit:	$5,256.00
• Total:	$57,616.00
• Say:	$58,000.00

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Proposed Electrical System:

• Demolition of obsolete/abandoned electrical equipment wiring and conduit:	$6,000.00
• Proposed emergency and egress lighting upgrade:	$8,000.00
• Proposed electrical panel surge protection device:	$3,100.00
• Proposed carbon monoxide upgrade:	$1,400.00
• Proposed exterior lighting upgrade:	$4,000.00
• Replacement of roof snow melting heat trace cable:	$1,000.00
• Proposed interior lighting upgrade:	$30,000.00
• Proposed receptacle and switches upgrade:	$3,700.00
• Proposed CCTV system upgrade:	$7,000.00
• Miscellaneous electrical connections for HVAC upgrades:	$3,000.00
• Subtotal:	$67,200.00
• 10% Overhead:	$6,720.00
• Subtotal:	$73,920.00
• 10% Profit:	$7,392.00
• Total:	$81,312.00
• Say:	$85,000.00

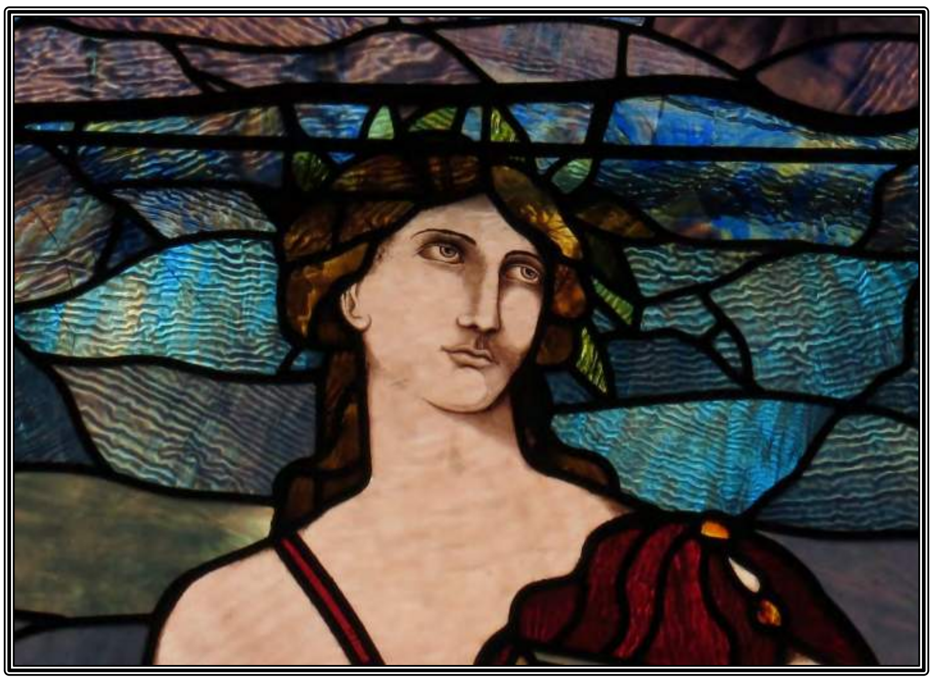
STAINED GLASS WINDOW CONDITION ANALYSIS

Clapp Memorial Library

Belchertown, MA

December 1, 2014

by Julie L. Sloan, Consultant



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STAINED GLASS WINDOW CONDITION ANALYSIS

Clapp Memorial Library

Belchertown, MA

Contents

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STAINED GLASS WINDOW CONDITION ANALYSIS

Clapp Memorial Library

Belchertown, MA

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SUMMARY

BASIC DESCRIPTION OF WINDOW

The window is located in the south wall of the library. It is 148″ tall and 100″ wide. It is composed of a central figural lancet surrounded by a wide borders. It is dedicated to John F. Clapp, founder of the library.

SUMMARY OF CONDITIONS

The window is in fair to good condition. There is some bowing as a result of missing saddle bars.

The window frame, the way the window is set in the frame, and the protective glazing require some attention. The frame needs to be scraped and repainted, and may have some small areas of rot. The protective glazing is not vented, and it is crazing in the border panels. The window is not caulked on the exterior and is set to daylight with minimum glass catch in the frame, providing no wind load strength.

RECOMMENDATIONS

The exterior of the window frame should be scraped to bare wood, primed, and repainted. The center window should be removed prior to painting, and properly reset after the window frame is painted. The border panels do not need to be removed. The old glazing putty on them should be removed and replaced. The protective glazing should be replaced with laminated glass that is appropriately vented to prevent the build-up of heat and moisture.

For the center lancet, two saddle bars should be replaced. The bowed sections should be flattened. When reset, the window or the frame should be altered to ensure that there is glass catch, meaning that the border leads extend into the frame so that at least 1/8″ of glass on all sides of the window is within the frame. The window should be caulked on both interior and exterior sides. The T-bars should have moldings.

We recommend that the window frame be inspected by an engineer to ensure its stability for wind load.

We estimate the cost of this work to be approximately $27,000.

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HISTORICAL BACKGROUND

The window was designed by H. (for Horace) Edgar Hartwell, a designer from New York, in 1886.[1] Not much is known about Hartwell. He was born in 1852 in Pepperell, Massachusetts, about 45 miles northwest of Boston, near the border of New Hampshire. Nothing is known of his education or training. Various ads in newspapers and magazines have him working as an architect, a decorator, a stained glass manufacturer, and a real estate agent. He began working in Boston and there at least until 1877, but by 1885 he was in New York. The most visible project that we found in our research was the interior decoration of an apartment for Mr. Artemas H. Holmes in the Villard Houses in New York, across Madison Avenue from St. Patrick's Cathedral. This home had a stained-glass window in the dining room depicting a knight in armor.[2] He showed designs for glass at the Third Annual Architectural League Exhibition in New York in 1887, but we do know what they looked like.

An article from the local newspaper describes the window as an original design of the figure of Poetry. "She holds in her hands a tablet and pen and the face bears the dreamy, far-away expression accorded to those of poetic cast."[3] The window was donated in memory of John Francis Clapp, donor of the library to the town, by his brothers.

According to the library, the window was releaded sometime in the 1920s. In 1999, the exterior frames were painted. In 2008, part of the ceiling collapsed and caused damage to the two lower sections of the center lancet. They were restored by William Murray, Alford, MA.

At some point, the original lead cames were replaced with what is there now, which is considerably wider than the original. The original size of the lead can be seen in the laylight over the circulation desk. We did not examine that window, but estimate its came to be approximately 1/8" wide. The average came width now is 1/4". This makes the window look less delicate than it originally looked.

---

[1] Hartwell had a son named Horace Edgar (b. 1880), and it appears that the son did business as an architect and interior designer using both names until at least 1917. Trow's 1890 *New York Directory* lists the officers of H. E. Hartwell Glass Works as Horace Edgar Hartwell, pres.; Louisa M. Hartwell, Sec., and Horace Edgar Hartwell as a trustee.

[2] "Some Notable Homes" and "Notable American Homes: Residence of Mr. Artemas H. Holmes," *Decorator and Furnisher* (April 1888): 5, 29-31.

[3] "Belchertown," *Hampshire Gazette*, August 31, 1886. My thanks to the library for providing this source, which also identifies Hartwell as the designer.

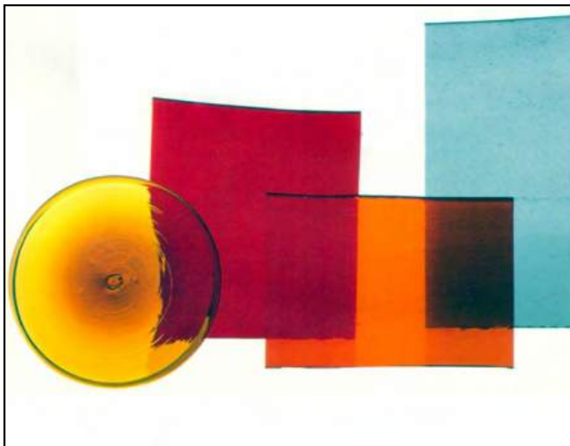
GENERAL INFORMATION ABOUT STAINED GLASS WINDOWS

Making antique glass, from *Harper's Monthly*, 1889

Since the Middle Ages, with the rise of Christianity, along with which the craft of stained glass was *developed* for the decoration of churches and cathedrals, stained glass windows have been created using essentially unchanged techniques and materials. A stained glass window is made up of pieces of glass, usually but not always colored, held together with metal strips called **cames**, usually made of lead. Some or all of the glass is usually painted. The following is a description of these materials, the manufacture and deterioration processes of glass, came, and windows, the techniques of fabricating stained glass windows, and a summary of the restoration process. Its purpose is to familiarize you with the materials and processes of stained glass and its restoration, to enable you to fully understand the condition of your windows and what is required to restore them.

GLASS

Most glass is made up of sand, lime, and soda melted together at temperatures above 2000^{o} F. The colors of stained glass are the result of the addition of various metallic oxides to the molten glass before it is formed into a sheet. These colors are permanent and do not, for the most part, change over time.



Antique glass

The glasses found in nineteenth- and early-twentieth-century windows are tougher than those used in the Middle Ages. The "glass disease" or corrosion commonly found in medieval windows is not a condition usually found in windows made after the seventeenth century. This was due to a change in the basic ingredients of glass. Early glass used potash instead of lime, which made for a softer glass, much more susceptible to attack by water and air pollution. This sort of attack requires centuries to become evident, but should never affect nineteenth-century windows.

Antique Glass

Making cylinder glass: Opening the cylinder
Chance Brothers Glass Co., England

There are essentially three types of glass used in stained glass windows, each characterized predominantly by its method of manufacture. The first is **antique**, or hand-made glass. The term has nothing to do with the age of the glass, but with its traditional means of manufacture: the glass is hand blown. Antique glasses are colored and transparent. Antique glass is somewhat irregular, often having bubbles (called **seeds**) or striations (called **straw marks**) which enhance its sparkle. Most nineteenth-century European painted stained glass windows are made of antique glass.

The most common technique for making antique glass is the **muff** or **cylinder** method. A quantity of molten glass is blown into a bubble at the end of a blowpipe and elongated into a cylindrical shape. The bottom of this long bubble is opened and the top cut from the pipe, resulting in an open-ended cylinder of glass, called a **muff**. After cooling (**annealing**), the cylinder is cut lengthwise and the glass reheated to allow it to be opened out flat. Muff glass is fairly even in thickness throughout the sheet (as compared to crown glass); sheets today usually range from about 2′ by 3′ to 3′ by 4′ in size.

There is little, if any, antique glass in this window.

Cathedral Glass

Clear cathedral glass

The next type of glass is **cathedral**. This transparent colored glass is made by pouring molten glass onto an iron tabletop and rolling it flat. Often the rollers are cut or grooved to impart a texture to the glass. The first machine-rolled glasses were made in the eighteenth century. These were rolled on one side only, but in the 1870s, the **double-rolled** process was invented in England to texture both sides of the glass simultaneously. Cathedral glasses are less brilliant than antique glasses, having a regular and somewhat dull surface texture. Different varieties of surface textures, such as ripples or ridges, are imparted by rollers during the manufacturing process.

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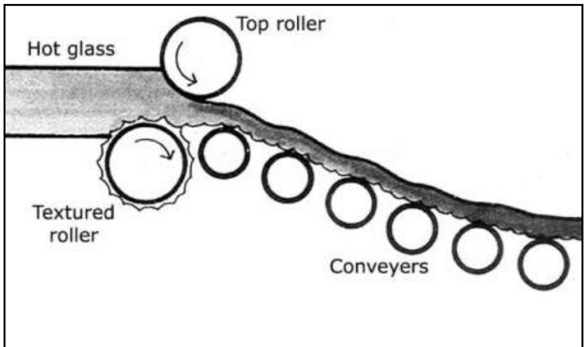
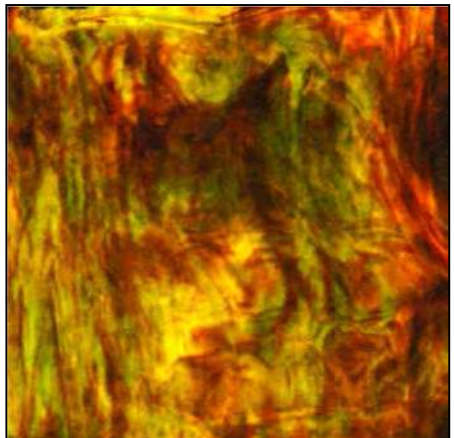


Schematic section of rolling device for cathedral glass manufacture.

Opalescent Glass

The third type of glass is **opalescent**. This glass is characterized by a milky opacity. Its colors are usually more pastel than vibrant. It is usually machine-rolled (and is therefore also a cathedral glass), but is sometimes further manipulated by hand. A sheet may incorporate more than one color. Opalescent glass is available in many of the same textures as cathedral glass, but is also found as a variety called **drapery** glass, which is formed by hand on the rolling table into thick, undulating folds imitative of drapery. Other types of opalescent are hand-cast, including **mottled** or **catspaw**.

Opalescent glass was developed in the late 1870s. Although John La Farge is often credited with the "invention" or "discovery" of opalescent glass, his major technical contribution was his patented use of such glass in layers for windows starting in 1879, thereby causing a revolution in stained glass design. Such milky glass had been used for glass vessels for many years. La Farge, however, was the first to incorporate this glass into windows on a large scale, and the first to commission glass manufacturers to produce it in sheets for the creation of stained glass windows. Louis Comfort Tiffany also commissioned opalescent glass from glassmakers, and later opened his own glass furnace to produce the glass for windows.


Opalescent Glass

The Clapp Memorial window is made of opalescent and cathedral glass.

JEWELS

These three-dimensional pieces of glass were used both for their textural effect, visible at night when no light illuminates the window, and for their diffusion of light during the day, adding visual interest to the window.

Many jewels were made by pressing molten glass into steel molds. The molds were cabochon (smooth) or faceted, and were available in many sizes and shapes.

There are many jewels in the borders of this window.

PAINT


Glass waxed up for painting

In addition to the basic color of the glass, most historic stained glass windows are painted with fired vitreous paint before they are assembled into windows. This paint, used to decorate or enhance stained glass windows, is made up of metallic oxides and ground glass. Paint sometimes imparts additional color, but usually is a dark opaque tone. Details such as facial features, drapery patterns, and inscriptions are usually painted. Vitreous paint has been used to delineate details in stained glass windows since the early Middle Ages.

The vitreous (glassy) powder is mixed in a liquid medium for application to the glass and then fired in a kiln at temperatures between 800^{o} and 1300^{o} F. During firing, the glass paint melts and fuses with the surface of the glass, making it very durable.

There are several kinds of glass paint. **Grisaille** (pronounced "gree-zi'" -- it rhymes with "brie sky") based on the ancient French term for "grey") or **glass-stainer's colors** are the oldest type of paint. They are dark, opaque browns, blacks, iron reds, and dull greens, usually applied to the interior surface of the glass. They are composed largely of iron and other metallic oxides with a small amount of flux (ground soft glass) to aid in their melting and fusing to the base glass. These paints are used for **trace** lines, the opaque outlines created with a thin brush, and for **mattes** (often spelled "matts"), the shadows created by thin washes of paint that are stippled or blended to suggest form and shape.

A second type of paint is **silver stain**. This is a transparent color that can range in tone from pale lemon yellow to deep orange. In reflected light, it sometimes has an iridescent metallic appearance. The name derives from the material used to produce the color: silver salts are applied to the exterior of the glass and fired at very high temperatures. It was discovered in the early fourteenth century as an application in stained glass. It is found in many types of windows, especially Gothic Revival windows. It is the most durable of glass paints.

The third type of glass paint is **enamel**. Enamels are colored paints made of ground colored glass. They tend to be paler in tone than colored glass, but can also be intensely colored. They are shiny, are usually found on the interior surface of the glass, and tend to be fragile because they are fired at low temperatures and sometimes do not fully fuse to the glass surface. Enamels were invented in the sixteenth century and are used to this day. They are found largely on heraldic panels and in opalescent figural windows.

Painting a waxed-up window
James Powell & Sons, Whitefriars, London

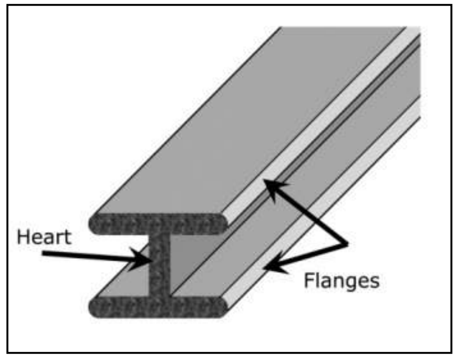
Often an artist other than the craftsman or glazier was the painter; sometimes the window's designer may have been the painter, but this was not always the case. The paints are mixed with various liquid media and other substances to aid in the application of the paint to the glass. These different media serve several purposes. In some cases, they handle differently, allowing the artist to obtain different effects. For example, an oil medium might be used for tracing very thin, fine lines, either with a tiny brush or with a steel pen. Alcohol or turpentine is often used for various degrees of soft appearance in a matte. A medium containing gum arabic or sugar is usually used for ordinary tracing. Another reason for using several different media is to allow the paint to be layered without firing between applications. For example, an alcohol matte can be applied over a water-and-gum trace line without fear of dissolving the trace line and washing it away. If a water matte were used over a water trace, the trace would first have to be fired.

A fourth type of paint found in stained glass windows is not technically a glass paint. It is referred to as **cold paint** because it is not fired, as glass paints are. Cold paint can be any type of unfired paint, including artists' oils, house paints, or glass paint that simply has not been fired. While old glass-maker's wisdom has it that "good" windows never employed cold paint, many windows made in the nineteenth century did in fact use cold paint extensively.

Much glass paint from the late nineteenth and early twentieth centuries is not as durable as it should be. This may be due to any one of a number of factors, ranging from inadequate heat or time in firing to a poor recipe or mixture of the color. Unfortunately, there are very few usable methods to conserve fragile glass paint, although it may be recreated.

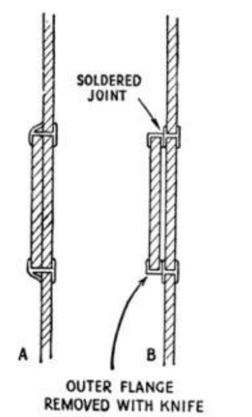
In the Clapp Memorial window, the face, arms, and feet of the figure are painted in grisaille, as is the inscription. There are no enamels or silver stain.

CAMES

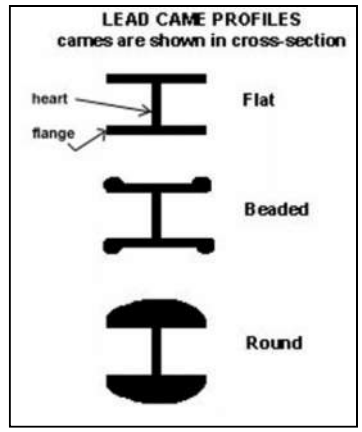


After the glass is cut, painted, and fired, it is held together with I- or H-shaped metal strips called **cames**. The pieces of glass fit between the **flanges**, or parallel legs, of the came. The center of the came is called the **heart**. The came is formed around the shape of the glass and joined at the ends with solder.

Cames were traditionally made of lead, and most still are, due to its malleability. Lead came is available in three basic profiles: flat, beaded flat, and round. Some late nineteenth century windows may have cames made of zinc or brass.



Plating, from Divine and Blanchford, *Stained Glass Craft*



Traditionally, stained glass windows are assembled in one contiguous layer. Occasionally a piece of glass will have another piece layered or **plated** over it to create a particular color effect, but this was not widely used until John La Farge patented it in 1880. In opalescent windows by La Farge and Tiffany, two, three, even as many as five or six layers of glass are plated together. Sometimes they placed two pieces of glass together and wrapped both in one came. Equally often, a piece of glass would be wrapped in its own came and soldered on top of other pieces wrapped in lead came. This was done to achieve both coloristic and atmospheric or perspectival effects. In many plated windows, and in some unplated windows made in America, the lead came is **floated**, or coated with solder.

Lead is mined with the silver ore with which it occurs naturally. It has always been the byproduct of the smelting of silver and, in the Middle Ages, the lead left after the silver was removed still contained as much as 4% silver. In the middle of the nineteenth century, the smelting process was improved to remove that remaining silver. As a result, the lead available to stained glass craftspeople after 1850 was virtually 100% pure lead. While this sounds like a benefit, a century later we have discovered that it is not. Pure lead came has a life-span of only about one century, while cames from the Middle Ages sometimes last several centuries. Research into this phenomenon has deduced that without the silver (or copper, which performs the same way and is less expensive), lead **fatigues** much more quickly. In lead came in stained glass windows, this fatigue is caused by expansion and contraction, the effect of which is noticeable as cracks or embrittlement. This cannot be reversed or corrected. As a result, most windows which are a century old require extensive releading. Typically the came used in Europe in the late nineteenth century is longer lived than that used in the United States. As a result, windows assembled in Europe are often in better condition than those made in the U.S. Came specified in restorations today should contain trace levels of certain metals other than lead to forestall having to relead the windows again in a hundred years.

It must be understood that while lead cames may superficially look fine in a window, and in fact may survive another generation if left alone, moving a window for any reason at all stresses the came and can rapidly accelerate its deterioration. This is because the heart of the came, which is not visible in a condition inspection, is eaten away by glazing putty and water. Left alone, the window maintains a status quo because the heart is not stressed. When moved, however, the window flexes; such movement cannot be avoided. This flexure can cause the heart to separate and came to the window's collapse. Therefore, windows from the late nineteenth and early twentieth century should never be moved without care and understanding that such moving may drastically reduce the time left before they require restoration.

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ASSEMBLY

To build a leaded glass window, a drawing is first done of the proposed design. Drawings are rarely done full size; they are small scale sketches. These must then be enlarged to full size in order to make the pattern, called a **cartoon**. The full sized design is copied onto paper twice. The original cartoon is kept for reference; one duplicate is cut up for patterns and the other is placed on the glazing table (called the **bench**) on top of which the window is assembled.

Drawing cartoons
James Powell & Son, Whitefriars, London

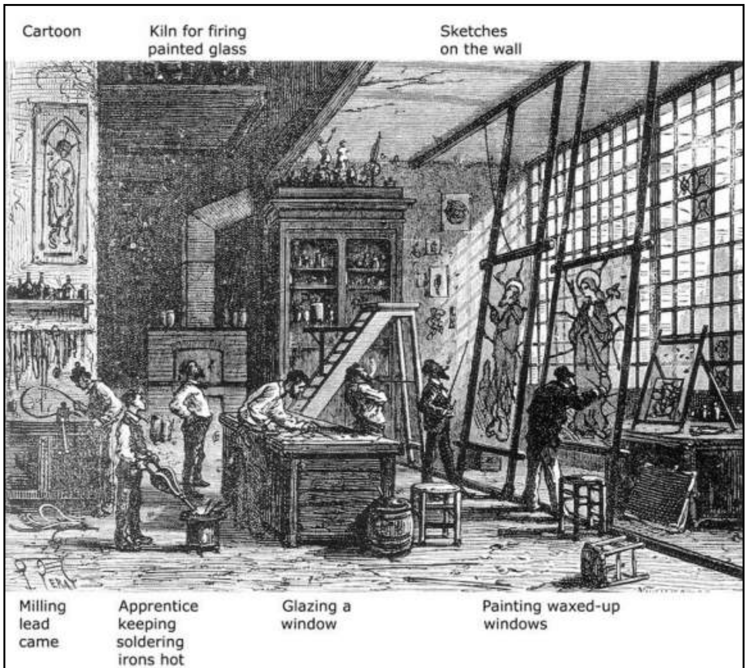
In order to cut the patterns, a three-bladed shear is used. This removes a narrow strip of paper between the pieces, leaving room for the heart of the came. The paper patterns may be tacked to the cartoon, or separated by color for cutting, depending on the nature of the design.

Colored glass is selected by the artist or craftsman piece by piece. After a piece has been chosen, the paper pattern is placed on top of the glass. Using a steel wheel glass cutter, the craftsman scores the glass around the pattern piece, following its edges exactly. The glass is separated by pulling away from the score. Burrs, slanted edges, or inaccurate cuts must be adjusted in order for the panel to fit together. This is done by **grozing** or chipping the edge with grozing pliers or a grozing iron, a steel tool with a notch cut in the side. Many modern glass cutters have grozing notches on their sides. By levering the glass in the notch of the grozing iron or in the mouth of grozing pliers, tiny chips are removed and the shape of the piece is minutely changed.

The pieces are then **waxed up** for painting. On a large sheet of plate glass, the lead line of the window is traced in black paint using the reference drawing. Each piece of cut glass is then attached to this plate-glass easel in its correct position, using a beeswax mixture to keep it in place. The easel is then placed vertically in front of a light source (a window or light box) for painting. Alternatively, painting may be done horizontally on a light table, in which case there is no need to easel the pieces on the plate glass.

Cutting glass
James Powell & Sons, Whitefriars, London

After application of the paint, the pieces of glass are removed from the easel and placed on a kiln tray, usually on a bed of whiting. The tray is then placed in a kiln for firing. Firing melts the flux of the paint and softens the surface of the glass, bonding the paint to the glass. In the late-nineteenth and early-twentieth centuries, kilns were fired with either gas or electricity; today, most kilns are electric. Prior to the discovery of gas and electricity, kilns were heated with wood fires.

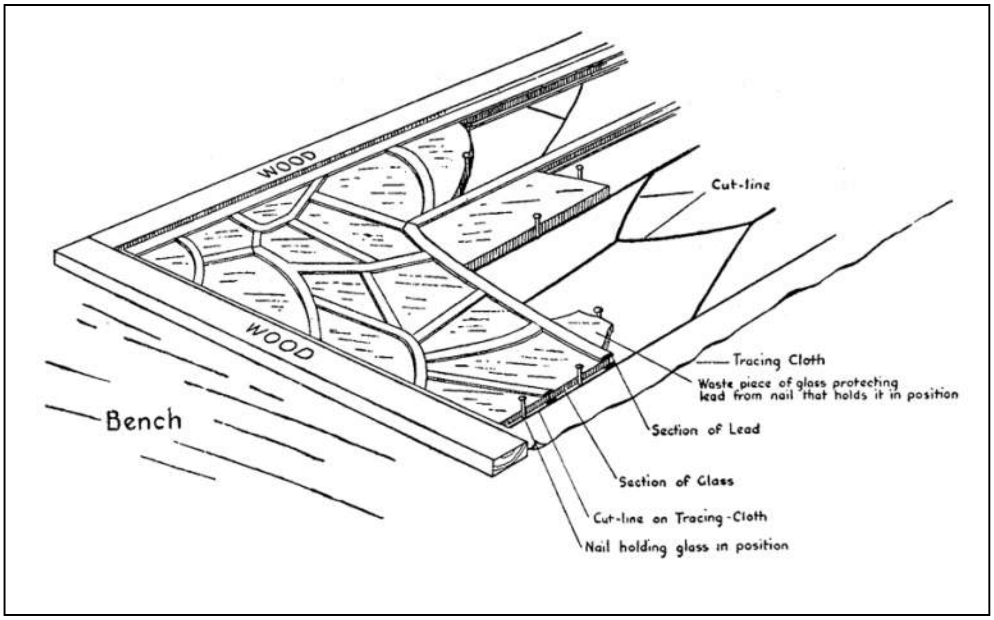


European studio, ca. 1888

When all the decorative processes on the individual pieces of glass are completed, the panel is ready for glazing. Placing the glazing diagram on the bench, strips of wooden lath are nailed to the bench as a guide for the corner of the panel. The cames for this corner are cut and placed against the lath, and glazing has begun. Working from one corner to the other, diagonally across the window, each piece of glass is placed into the came, then another piece of came is cut and placed, then glass, and so on. The glazing guide beneath the panel ensures that the pieces are placed correctly and that the size of the panel is kept accurate. In order to keep the assembly, which is not yet soldered, from coming apart, large nails are driven into the bench at the edges of each newly placed piece of glass. When the opposite side is reached and all the glass and came are in place, all the nails are removed and laths are nailed into place on the final two sides of the panel. The panel is ready to be **soldered**.

All the joints of the panel must be soldered on both sides. Before soldering, they must be **fluxed**. Flux cleans the came and assists in the distribution of heat to allow the solder to flow smoothly. There is a variety of fluxes; in the Middle Ages, tallow was used. Today, zinc chloride, oleic acid, stearic acid, and other materials are used. Flux is wiped onto every joint and the heated soldering iron touched to the solder and the joint to melt the solder into the joint and connect the cames. When the upper side of the panel is completely soldered, the laths are removed and the panel must be carefully turned over to solder the other side. After soldering, the panel is cleaned to remove all traces of flux.

Glazing at James Powell & Sons, Whitefriars, London



Although the process of making a stained-glass window is not difficult, as in any other craft it requires practice. There are things that make glazing substandard. These include using a too-cool soldering iron or using the wrong solder or flux, which causes pointed or lumpy joints; using came of the wrong size, profile, or metal; not lining up cames that should continue from one section to another, or across a bar line or another came; failing to remove all of the flux, which can cause corrosion.

With the development of opalescent glass in the 1880s, artists began layering glass in their windows in an effort to obtain a wider variety of color and atmospheric effects and obviate the need for glass paint. Some opalescent windows have as many as eight layers of glass. The Clapp Memorial is mostly a single layer. The exception is the figure: her red dress is composed of two layers. The outer layer of glass is red. The inner layer is white and clear; it provides the texture and the illusion of depth to the folds of cloth.

WATERPROOFING


Waterproofing in Tiffany Studios

After soldering the stained glass panel, a **waterproofing compound** is forced beneath the flanges of the came to seal and weatherproof the window. Traditionally, this was a putty made of boiled linseed oil, whiting, red or white lead, kerosene, and lampblack. It was usually mixed to a fairly soupy consistency and brushed under the flanges, but sometimes it is a thicker, clay-like mixture that is thumbed into the cames.

Linseed-oil-and-whiting waterproofing has a lifespan of between about forty and one hundred years. Its durability is dependent upon its formulation and the conditions under which it has weathered. In restoration in America today, linseed-oil-and-whiting putty is still the best waterproofing material, far outlasting any modern synthetic putty. Many modern recipes for glazing putty often include a portion of Portland cement. This is **not** a desirable additive, because it sets too hard. Windows puttied with Portland cement cannot move with lateral pressure; stained glass windows need to move slightly, to be able to flex with wind pressure and to expand and contract with thermal variations. Often windows bow shortly after installation; when Portland putty sets, these bows become permanent. Windows puttied with Portland cement cannot be disassembled for repair or restoration. Should glass break or the window otherwise deteriorate, restoration is impossible.

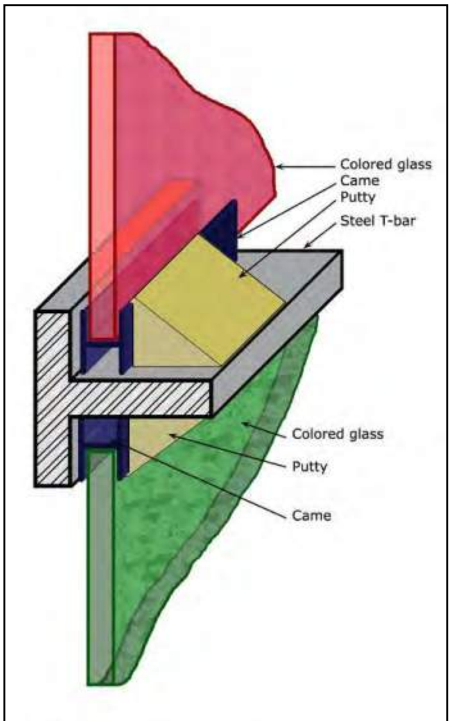

Cleaning oil off a window after waterproofing

Setting compound

Linseed oil putty is often used to set the window into the window frame, either as a bevel in rabbeted frame or a setting bed in a grooved frame. In mid-twentieth-century windows, the setting compound may contain asbestos, a common additive to window putties during the period. If this is the case, if the window needs to be removed for restoration, asbestos abatement contractors will have to be involved.

SUPPORT BARS

Stained glass windows generally require **support bars** to assist in keeping them in a flat vertical position. These bars are necessary, even though they may interfere with the design. Stained glass designers who understood the necessity of bars worked them into the design. This can be seen in medieval windows, where the bars outline medallions.

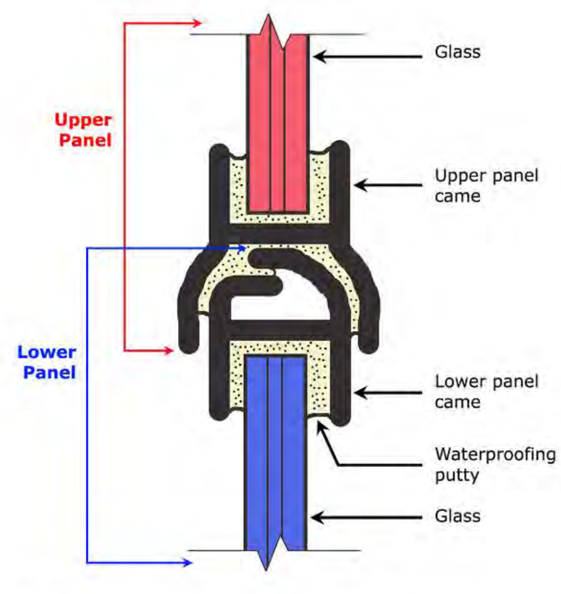


T-bar cross-section

There are several kinds of support bars. Generally they are made of steel or iron.

T-bars are steel or iron bars shaped like a T set on its side. These bars support a stained glass panel at its lower edge. Often there is one or more T-bars in a window, ensuring that the entire weight of the window is not resting on the bottom border or the sill, but is distributed more evenly to the jambs. There are two aluminum T-bars in the Clapp window, but these are not original. They probably replace stacked joints.

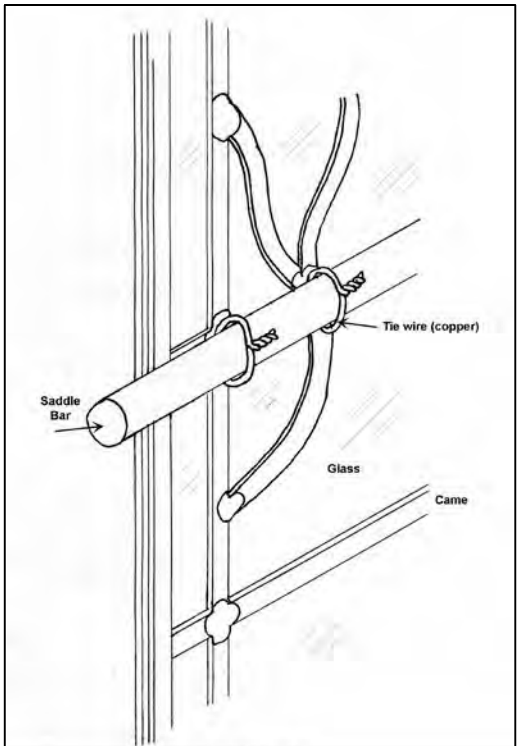
Windows that are set without T-bars between sections have **stacked** or **meeting joints** between sections. This means that all sections rest on the sill, each supported by the section below it. A saddle bar should be installed at the meeting joint, instead of a T-bar. One stacked joint remains in the Clapp window, at the saddle bar just above the figure's head. The joint is not a straight line – it follows the shapes of the clouds. This is probably why it was not replaced with a T-bar.



Stacked or meeting or piecing joint

Saddle bars are round, square, oval or flat bars which span the surface of a panel and extend beyond it into the surround. They should be set into the frame or sash and fastened to the window. A common design for round saddle bars features a flattened, or spooned, end. This flattened end may be set into the groove or rabbet and held only by putty and the pressure of the window (usually seen only in stone frames); or they may be pierced and screwed to the frame (usually found only in wood frames).

The most ancient and traditional method of fastening a saddle bar to a panel is by use of **tie wires**. Tie wires are copper wires soldered to the stained glass panel and twisted around the saddle bar after installation to hold the panel against the bar. Beginning in the late nineteenth century, flat bars have been used, soldering the narrow edge of the bar directly to the panel instead of using tie wires.



Round Saddle Bar

Round saddle bars are sometimes replaced with flat bars soldered to the window instead of tied. This technique was especially popular in the 1970s. It is often not an adequate solution to settling and if done poorly can damage the lead came of a window.

EXTERIOR PROTECTIVE GLAZING

EXISTING PROTECTIVE GLAZING

The existing protective glazing is a rigid plastic, probably polycarbonate. Although it is not yellowed or scratched, it has begun to craze internally. It is no longer unbreakable and is not protecting the window from anything but rain at this point. It has no ventilation to allow air circulation. It is held in place with quarter-round moldings that are warping, splitting, and falling off the center lancet.

THE PURPOSE OF PROTECTIVE GLAZING

The issue of protective glazing is a sticky one. Many windows do not require it. If installed improperly, it can cause more damage more quickly than any other factor except vandalism.

It has limited value as an energy conservation measure in a historic building. A recent study in Europe that single-pane protective glazing can reduce energy loss by a factor of 2, and insulated units by a factor of 3.5, but that this was insignificant when compared to the energy loss through a historic building's walls and roof. Other energy-saving measures within a historic building, such as lowering thermostats, were far more effective, especially when weighed against the cost of installing protective glazing.[4]

Generally we do not recommend its use <u>except</u> 1) if the building is in area where vandalism, theft, or accidental breakage from impact (located next to a playground, for instance) poses a real and significant threat; or 2) if the windows contain fragile glass or glass paint which would otherwise be exposed to the elements; or 3) if restoration procedures or materials have been used which are not weather-stable (such as epoxies); or 4) if the market value of the windows is extraordinarily high and/or the cost of restoration would be very high in the event of damage.

VENTILATION

By far the most critical aspect of protective glazing is its ventilation, which must allow a complete and continuous exchange of air between the stained glass and the protective glass. If this exchange does not occur, moisture will collect between the stained glass and the protective glass. It is impossible to completely seal that space because a stained glass window will always leak air. This trapped moisture will condense on the came and very rapidly corrode the glass, glass painting, glazing compound, and came. It will also cause extensive damage to the framing of the window and often seeps to the interior of the building, causing damage to plaster and finishes. This will happen more quickly in a closed environment than in an open one, because water is always present. Therefore, unventilated protective glazing will actually damage a stained glass window more quickly than natural aging could.

One of the principle questions surrounding the design of protective glazing concerns whether to the vent to the inside of the building or to the outside. There is no one simple answer; it depends on many conditions, including the framing materials, the type and condition of the stained glass, the construction of the building, and the orientation of the windows to the sun. Generally speaking, it is usually less expensive to vent to the exterior; and it is usually impossible to vent to the interior in stone settings or if the windows are not being removed.

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[4] Sophie Wolf and Stefan Trümpler, "Conflicting Priorities: Protective-Glazing Systems in the Light of Current Energy-Conservation Strategies," *Vidimus*, issue 78, March 2014, www.vidimus.org. See also S. Wolff, S. Trümpler, K. Ghazi Wakili, B. Binder, and E. Baumann, "Protective Glazing: The Conflict Between Energy-Saving and Conservation Requirements," in H. Roemich and K. van Lookeren Campagne, eds., *Recent Advances in Glass, Stained-Glass, and Ceramics Conservation,* Zwolle, 2013, pp. 99-108.

GENERAL RECOMMENDATIONS

Glazing Material

Plastics

We do not recommend the use of a plastic material, such as polycarbonate (General Electric's Lexan®) or acrylic (Plexiglas® or Lucite®). Polycarbonate, the toughest available plastic, is sold as being unbreakable, but the manufacturer guarantees this for only 2 years. Tests and experience have shown that polycarbonate becomes very brittle after five to ten years of exposure, and by that time can be as easily broken as glass. In addition, despite manufacturer's claims to the contrary, polycarbonates change in appearance after several years of exposure. They can become opaque, scratched, or yellowed.

Acrylics are more brittle than polycarbonates, although cell-cast acrylic is stronger than other forms. Acrylic tends to yellow and scratch from wind abrasion more rapidly than polycarbonates.

The rate of expansion of plastics is very high, and if not set properly— i.e., if set by drilling through the plastic to fasten it —shear tears, cracks, and other degradation usually occurs as a result of expansion stress. In addition, the warping and bowing of plastic gives the building an unattractive appearance and contributes to its degradation over time.

A better installation requires the plastic sheet to be set in wide frames, usually aluminum. These frame sections, which are sold specifically for the storm glazing of stained glass windows, are usually 2″ to 3″ wide. Unfortunately, it is extremely rare that such framing can be made to coordinate or harmonize with the exterior appearance of an historic building.

As a result of these various degradation modes, plastics typically require replacement within ten years.

Finally, the cost of polycarbonate averages four times the cost of glass. Compounding this cost every ten years makes polycarbonate an extraordinarily expensive, as well as unattractive, alternative.

Glass

We recommend the use of glass for protective glazing. In most buildings, we recommend ordinary laminated glass, at least 3/8″ thick. Although the glass itself can be broken on impact, it is far more difficult to penetrate the polyvinyl inner layer of the laminated glass, which preserves intact the stained glass it's protecting. If there is a very high risk of vandalism, burglar-resistant laminated glass is also available.

Due to the difficulty of cutting laminated glass into complex shapes required in tracery, ordinary 1/4″ plate glass is generally sufficient in these areas, which are usually quite high up on the building and therefore protected from ordinary vandalism.

In areas where accidental breakage, such as falling tree limbs, may be a more realistic concern, tempered glass may be suitable. The process of heat-strengthening creates a glass that is typically two to four times as strong as ordinary plate glass. Tempered glass cannot be used in windows with complex tracery, nor can it be used in settings that require drilling of the glass for fastening.

Framing and Setting

Designing a framing and setting system is often the more difficult task. In general, framing should be visually subordinate. It should not obscure tracery and framing on the exterior, or cause shadows on the stained glass from the interior. It should place the protective glazing not less than 1″ away from the stained glass. Mullions, if required, should align with mullions or major divisions in the stained glass windows themselves so that the exterior mullions do not cast shadows on the stained glass visible from the interior.

Whatever kind of framing is designed, the space between the stained glass and the protective glass must be vented to allow full circulation of air. Vent holes at the top and bottom of each independent light is required. The jambs should be sealed, which will create a convection current and allow air movement.

Venting to the interior is possible. Interior venting is the best setting for the stained glass, since it surrounds it with interior air, keeping the temperature and humidity equal on both sides of the window. This tends to prevent the formation of condensation on the stained glass itself. On very cold days, condensation may form, but it will be on the protective glazing.

If the sanctuary is to be air-conditioned, ventilation should be to the interior to prevent energy loss. In this case, the protective glazing can be made of an insulated unit.

RECOMMENDATIONS

The existing plastic glazing should be replaced with 1/4" laminated glass, affixed to the existing wood with wood moldings of sufficient size not to warp and split; or with aluminum molding sections, such as J. Sussman 200 series. There should be vent holes at the top and bottom of each independent light, and no holes on the sides.

COST ESTIMATES

Restoration costs include the recommended work, including removal; transport to a studio within 300 miles of the building; flattening; addition of new ties for missing bars and replacement of existing tie wires; scraping and painting of window frame; provision and installation of protective glazing; transport of the stained glass back to the building; reinstallation of the stained glass; and replacement of putty bevels on the border sections.

Estimates do not include scaffolding, major alteration to existing framing, or fabrication of new framing for protective glazing. They also not include project management costs.

Estimates are valid for six months from the date of this report.

We make every effort to provide estimates that reflect the current status of high-quality restoration costs. We try to provide you with an estimate to serve as a ceiling figure. However, as in any estimate, actual contractor costs may vary substantially from this, due to factors over which we have no control, including the number of employees, overhead costs, and how much they want the work.

There is great diversity in the field of stained glass contractors. Some studios are very large, with 30 or more employees. A typical restoration studio has 8-15 employees. There are many studios with one or two employees. Naturally, the costs of these types of businesses will vary. Experience and location are also factors in the cost of a studio.

We estimate the cost of this work to be approximately $27,000.

GLOSSARY

Antique glass: Hand-made, mouth-blown glass.

Bench: The table on which a window is assembled, or glazed.

Came: H-shaped lead strips that hold the stained glass window together. Glass fits between the parallel legs of the H.

Round came has a rounded profile on both sides.

Flat came has a flat profile on both sides.

Beaded came is flat with a ridge at the outer edges of the flanges.

Cathedral glass: Machine-rolled glass with imprinted texture on one or both sides.

Cat's-paw glass: (also called **mottled** glass) An opalescent glass which is mottled with deeper colors, the mottling said to appear like the footprints of cats.

Cold paint: Unfired paint applied to stained glass window. It may be any of a variety of paints.

Dedication: The name and dates of the commemorated individual or group; as opposed to an inscription, which is the verse.

Enamel: In the context of this report, a fired glass paint that is translucent and colored, made of ground colored glasses.

Fillet: A narrow rectangular border.

Flashed glass: An antique glass made of two differently colored layers: a thicker base layer usually of a pale, transparent color, such as clear, yellow, green, or blue, and a thinner flashed layer, usually a deep intense color, such as red or cobalt blue.

Flux: An acidic compound applied to metals to be soldered; it cleans the metal in preparation for soldering.

Grisaille: In the context of this report, a fired glass paint that is dense and opaque, made of metallic oxides, usually black or brown in color.

Grozing: A process for shaping glass pieces whereby a grozing iron or grozing pliers are used to chip away minute fragments of glass.

Head: The portion of the lancet above the spring line.

Inscription: The verse in the window, as opposed to the **dedication**, in which the commemorated individual or group is named.

Lancet: A tall vertical window opening.

Opalescent glass: Glass that is opaque or partially opaque, giving it the translucent qualities of an opal.

Plates, plated, plating: The layers or layering of one or more pieces of glass over one or more others to create a window that may be several layers thick.

Putty: See **Waterproofing**.

Rabbet: sometimes also called "rebate": an L-shaped groove cut into a frame (usually wood or metal) into which the glass is set. The glass is held in place with moldings or putty bevels. See also **groove**.

Saddle bars: A type of **Support bar**: saddle bars are applied to the surface of a stained glass panel and should be set into the frame or sash to transfer the weight of the panel to the frame or sash; they are also important in keeping the panel from bowing laterally.

Solder: A lead-tin alloy that, when melted on the tip of a soldering iron, flows to metallic elements, such as came or copper foil, to hold those elements together when the solder cools.

Spring line: The point at which an arch begins to curve.

Strap lead: A piece of lead flange applied to a piece of glass to cover a crack.

Support bars: Saddle and **T-bars** used to support the stained glass window in the window opening.

T-bars: Steel or iron bars in the shape of a T set on its side into the sash or frame; the stained glass panel is set on top of the leg of the T.

Waterproofing, waterproofing compound, or putty: A thick putty or cement made of linseed oil and whiting, that is forced between the glass and lead came to prevent water and air from passing between them; it also stabilizes the stained glass panel.

CONDITIONS

WINDOW NAME	**Clapp Memorial Window, "Poetry"**					
INSPECTION DATA						
Inspected by	***JLS***	WJP				
Inspection Date	**11/4/2014**					
Weather	**50 degrees, sunny**					
How was Inspection Done	***Up-close***	***Binoculars***	Other:			
STAINED-GLASS (SG)						
IDENTIFICATION						
Window Date	***1886***					
Studio						
Artist	***H. Edgar Hartwell, New York***					
Window Location	Aisle	Clerestory	Balcony	Sacristy	Organ Loft	Parish House
	Basement	***Other: End wall***				
Window Orientation	N	**S**	E	**W**		
TEXTS AND ICONOGRAPHY						
Inscription (bible verses, saints' names, anything else written)						
This window is erected by Everett, Edward and Dwight, in remembrance of their Brother, John Francis Clapp, who gave to his native town, This Library Building & Grounds, & 5000 vols of books with an invested fund for their maintenance.						
Iconography (scene, symbols)						
A female figure in red toga, holding a book and pen, floating in the sky.						
SIZE IN INCHES						
Overall Width	***100"***					
Overall Height	***148"***					
Lancet Width	***sides, 30"***	***center, 60"***				
Lancet Height	***102"***					
ORGANIZATION						
How Many Lancets	***1***					
How Many Sections per Lancet	***4***					
Is there Tracery	Yes	***No***				
How Many Tracery Openings						
Notes	***One large center opening framed by wide border panels***					
FRAME						
Frame Type	***Fixed in center and top***	***Double-hung in side borders***	Casement	Vent	Other:	
Window Frame Material	***Wood***	Stone	Steel	Aluminum	Bronze	
	Other:					
Water Infiltration	Sill	Left jamb	Right jamb	Center mullion	Tracery	
	Other:					
Rot, Loss, Corrosion Locations	Sill	Left jamb	Right jamb	Center mullion	Tracery	
	Other:					

Frame Interior Finish Type	***Paint***	***Clear coat***	Powder coat	***Other: Sashes are painted; frame has a clear coat finish***		
Interior finish condition	Poor	***Fair***	***Good***	Excellent		
Frame Exterior Finish Type	***Paint***	Clear coat	Powder coat	Other:		
Exterior finish condition	***Poor***	Fair	Good	Excellent		
Interior or Exterior Set	Interior	Exterior	***Glass is set into sashes from the exterior; sashes are set from the interior***			
Frame or Sash Alignment	***Aligned***	Out of plumb	Twisted	Other:		
Groove or rabbet	Groove	*Rabbet*				
Setting material	Caulk	***Putty bevel***	*Molding*	Other:		
Setting material condition	Poor	*Fair*	Good	Excellent		
Notes	***In the border, the sashes have square lights around the edges; the square quarries of glass are puttied in the wood mullions. Sashes are set into frames with moldings. In the center lancet, the panels are back-bedded in sealant but have no exterior bevels. Center panels are set to daylight with no catch in the sash. There appears to have been a strut screwed across the frame horizontally just above the springling. The frame retains marks of screws and damage to the finish, and on the right side, the plaster has been chipped at this point.***					
BARS						
Are sections stacked or have T-bars	Stacked	***T-bar***				
How Many T-Bars	***2***					
T-Bar Size	1 x 1 x 1/8	***1 x 1 x 1/4***	1-1/4 x 1-1/4 x 1/4	Other:		
T-bar material	Steel	***Aluminum***	Bronze	Other:		
Location of T-Bar Bevels	Interior	***Exterior***				
T-bars corrosion	***None***	Minor	Moderate	Severe		
T-bar bevels cracked	***None***	Minor	Moderate	Severe		
T-bar bevels missing	None	Minor	Moderate	***Severe***	***T-bars should have moldings, but they are missing***	
How Many Saddle Bars excluding vents	***3 in each double-hung sash; 2 in each of the upper border panels; 2 in each of the lower sections of the center; 5 in the top section of the center***					
Saddle bar size	1/4"	3/8"	***1/2" in center***	5/8"	***Other: 3/16" in borders***	
Saddle bar profile	***Round***	Flat	Square	Other:		
Saddle bar material	***Steel***	Iron	Bronze	Brass	Other:	
Saddle bar corrosion	***None***	Minor	Moderate	Severe		
Were there enough original tie wires per bar	***Yes***	No				
Tie wires torn	None	***A few***	Most	All		
Tie wires broken	***None***	A few	Most	All		
Notes	***The T-bars are not original. These were probably stacked joints. Two saddle bars are missing in each of the lower sections of the center.***					

VENTS						
How Many Vents	***0***					
GLASS						
Glass Types	Antique	***Cathedral***	***Opalescent***	Flashed	Slab	Dalle de verre
	Other: Pressed jewels					
How Many Layers	***2 in figure; one everywhere else***					
% Broken	Less than 5%	***5% to 10% in border and upper section of center***	***10% to 30% in lower two sections of center, due to ceiling collapse in 2008***	30% to 50%	50% to 70%	70% to 100%
% Missing	***Less than 5%***	5% to 10%	10% to 30%	30% to 50%	50% to 70%	70% to 100%
Is broken glass repaired	None	Some	***Most***	All		
How is broken glass repaired	Lead flanges	Through leads	***Glue***	Caulk	Duct tape	Clear tape
	Other: Copper foil					
Amount of Dirt	***Light***	Moderate	Heavy			
Type of Dirt	***Dust***	Soot	Wax	Nicotine	House paint	Powder
	Crust	Film	Other:			
Location of Dirt	Around came	In glass texture	Between layers	***Overall***	Other:	
Notes	***Bottom two sections of center were restored by William Murray, Alford, MA, in 2008 after ceiling collapse damaged them. Several pieces were replaced, including the feet and outside plating around the feet, and the top center off-white piece in the dedication; these were well done. The breakage is still visible, which is not an issue, providing it was glued. Several pieces appear to have been glued to a backing piece; this is a not an advisable technique because it is not reversible. It is not clear why this was done. There is a large crack in a piece of exterior plating that appears to be newer; it is not aligned and might be in danger of falling into the space between the plating.***					
GLASS PAINT and DECORATION						
Paint Types	***Grisaille***	Silver stain	Enamel	Cold paint	Other:	
Other Decoration	Acid-etch	Sandblast	Other:			
Condition	Poor	Fair	***Good***	Excellent		
Type of problem	Patchy losses	Losses that look like fading	Color change			
Location of problems	In traces	In mattes	In enamels	In cold paint	In backgrounds	In drapery
	In flesh	In writing	Other:			
Notes	***Feet were replaced in 2008.***					
CAME	Came is lead unless otherwise noted					
Came Metal if other than lead	Zinc	Copper foil	Other			
Came Profile	***Round***	Round beaded	***Flat***	Flat beaded	Colonial	

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	Other:					
Came size(s) (roughly)	1/8" or smaller	***3/16"***	***1/4"***	3/8"	***1/2"***	5/8"
	3/4"	7/8"	1"	Greater than 1"	Other:	
Corrosion	***None***	***Minor***	Moderate	Severe		
Cracking	***None***	Minor	Moderate	Severe		
Does it tear	***None***	Minor	Moderate	Severe		
When bent, does it turn white	Yes	***No***				
When bent, does it break	Yes	***No***				
Bowing or sagging	None	Minor	***Moderate***	***Severe***		
Where is Bowing	***In lower two panels of the center, due to missing bars.***					
How Much Out of Plumb	Less than 1/2"	***1/2" to 1"***	1" to 2"	More than 2"		
Percent to be Replaced	***Less than 25%***	25% to 50%	50% to 75%	75% to 100%	100%	
Waterproofing cement condition	Poor	Fair	***Good***	Excellent		
Notes	***The window was releaded in the 1920s and again more recently. No original came survives. Based on our knowledge of windows of this era and on surviving lead came in the laylight above the circulation desk, we feel that the original came was probably significantly narrower than what exists now. This would have made the window look more delicate.***					
PROTECTIVE GLAZING (PG)						
Is There EPG	***Yes***	No				
When was it Installed	Original	More than 40 years ago (pre-1970)	Within last 40 years (since 1970)	***Within last 20 years (since 1990)***	New	
Glazing Material	Textured glass (original)	Textured glass (not original)	Window glass	Plate glass	Laminated or tempered glass	**Plastic**
	Polycarbonate (Lexan)	Acrylic (Plexiglas)	Other:			
In own frame or in SG frame	Own frame	***SG frame***				
Full frame or just mullions	Full frame	***Mullions***	None			
Frame Material	Wood	***Aluminum***	Steel	None		
How Much Space Between SG and EPG	Less than 1/2"	1/2" to 1"	***1" to 2"***	More than 2"	***Except in upper sashes of double-hung units, where the protective glazing is set against the window sashes.***	
Is it intentionally vented	Yes	***No***				
How is it Vented	Holes drilled in glazing retroactively	Holes drilled in frame retroactively	Holes drilled in glazing intentionally	Holes drilled in frame intentionally	Vents built into frame	
	Space at top	Space at bottom	Space in tracery	Screened		

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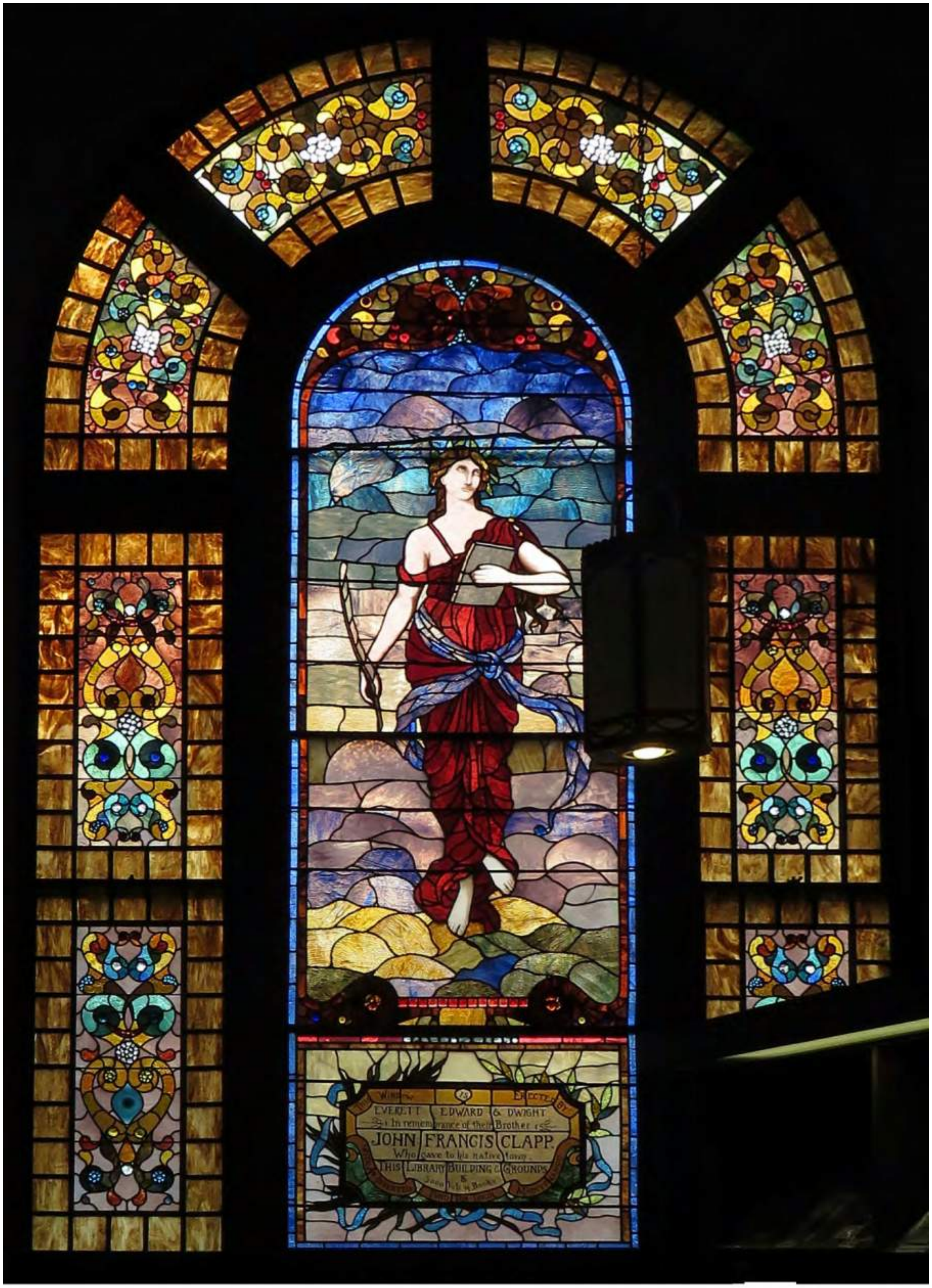
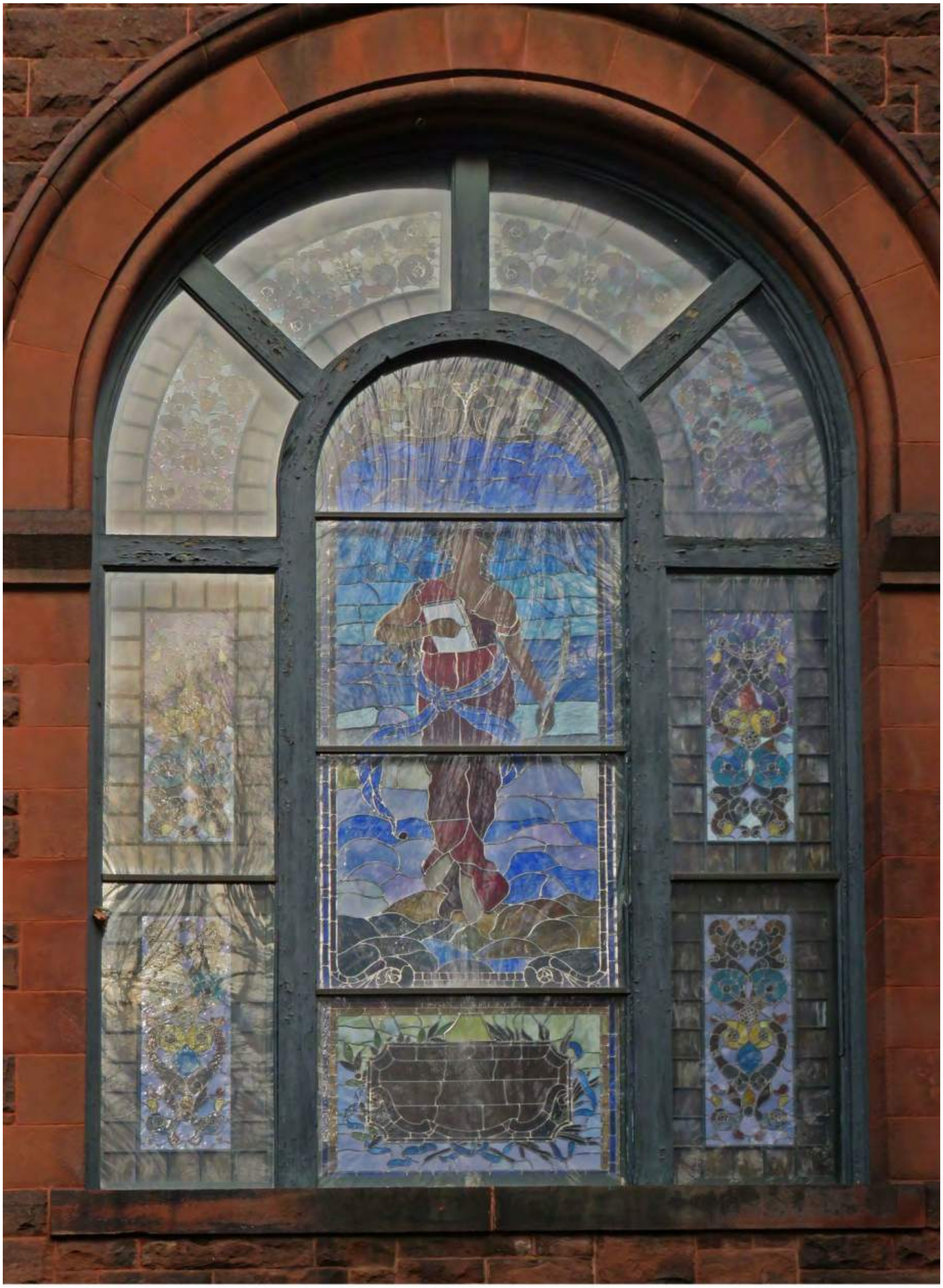
	To interior	To exterior	Isothermal (to interior with sg in separate frame)	Other:		
Is New EPG Needed	***Yes***	No				
% Broken	***Less than 5%***	5% to 10%	10% to 30%	30% to 50%	50% to 70%	70% to 100%
% Missing	Less than 5%	5% to 10%	10% to 30%	30% to 50%	50% to 70%	70% to 100%
Dirty or cloudy	None	***Minor***	***Moderate***	Severe		
Frame condition	***Poor***	Fair	Good	Excellent		
Notes	***There is crazing in the protective glazing in the borders. The plastic is held in place at the jambs with quarter-molding. In the right jamb of the center sections, this is split and warped. Paint on the frame is badly peeling.***					
General Notes						

ILLUSTRATIONS OF WINDOWS AND CONDITIONS



Clapp Memorial Window



Plating

Only the figure's gown is plated with two layers of glass. On the exterior (left), is red glass that protrudes from the surface of the window. This is the plating. On the interior (right), the base layer of glass is whitish, which can be seen in reflected light, as at night when no light comes through the window. Also notice there are more pieces on the interior gown than the exterior.

Face

Dedication

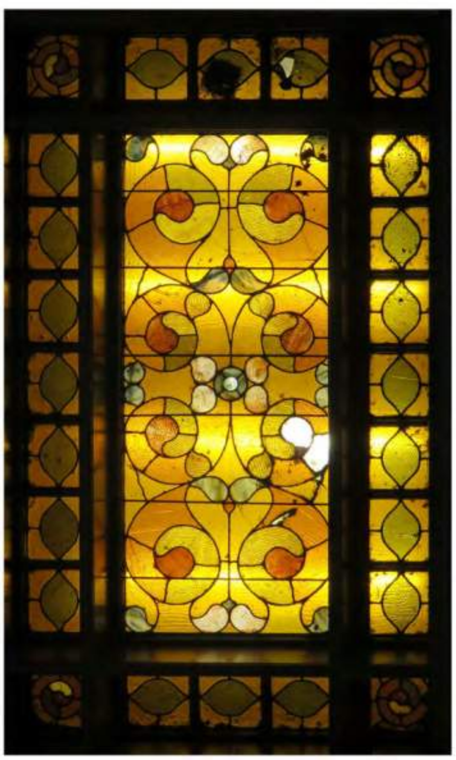
Painting

Most of the glass is not painted. The flesh pieces (face, arms, and feet) and the dedication are the exception.

Above: In the border on each side of the figure, two of the sections are double-hung sash which no longer operates.

There are a number of hand-faceted glass jewels used in the window, primarily in the border, but also above the figure.

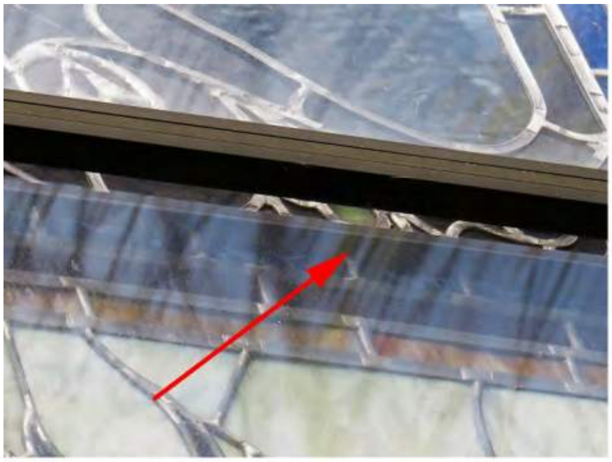
This is another type of hand-made jewel, intentionally textured with a crackled surface.



Laylight

The laylight above the circulation desk has the original lead. The Clapp Memorial window's lead came is much wider than the original came, which can be seen more clearly in the building where the two windows can be compared. During the next releading of the window (which is not required at this time), care should be taken to replace the existing came to match that in the laylight.

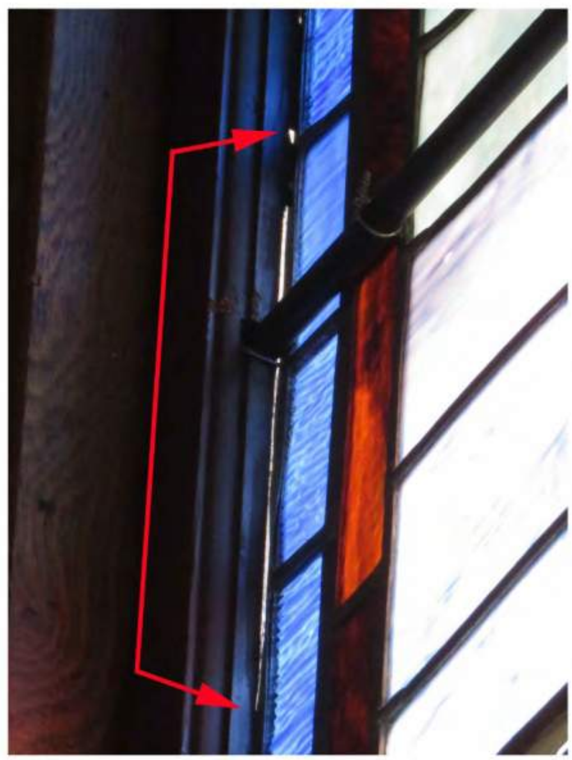
At some point in the past, it appears that there was a wood or steel strut that spanned the window frame just above the springline. It did not line up with the horizontal frame members in the border. Marks from it were left in the wood, and plaster was damaged on the right jamb when it was removed. We recommend that the frame be inspected for structural stability.



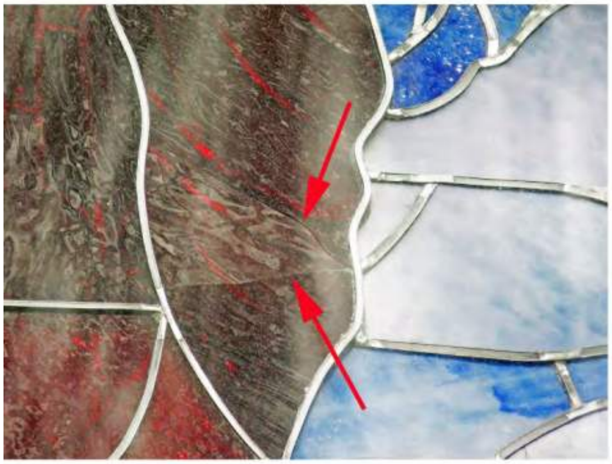
Originally the window was set either with stacked joints or with steel T-bars. These were replaced, probably in 2008, with aluminum T-bars. (The protective glazing is also set with aluminum bars.) The bars supporting the stained glass are missing their exterior snap-in molding beads (left, on the inside layer). In the photo on the right, you can see that the window is "set to daylight" with no glass catch. This means there is no glass in the frame to support the window. It appears to be held only by interior sealant (there is no exterior sealant) and the saddle bars, two of which are missing.

There is bowing in the two bottom sections of the figural lancet where bars are missing. This is one area.

Locations of missing bars are easy to determine because the holes for them still exist in the frame.



Light leaks (gaps) where the window does not sit tightly in the frame, at the upper left jamb of the center lancet.



Breakage
On the left is what appears to be new breaks in the outer plating. On the right is breakage from the ceiling collapse that has been glued.

This piece was glued to a backing plate. Bubbles in the glue are clearly visible through the glass. This cannot be easily reversed.

Replacement glass
A few pieces of glass were replaced in the 2008 restoration. They were well done. On the left, both of the figure's feet are new. On the right, the piece identified by the arrow is new.

The exterior of the window frame exhibits a great deal of flaking and peeling paint. This should be scraped to bare wood, primed, and repainted.

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More examples of peeling paint on the frame.

The protective glazing is held in on the side with quarter-round moldings. These are also peeling, as well as splitting and warping.

The protective glazing is plastic. It has become very crazed. It should be replaced with laminated glass.

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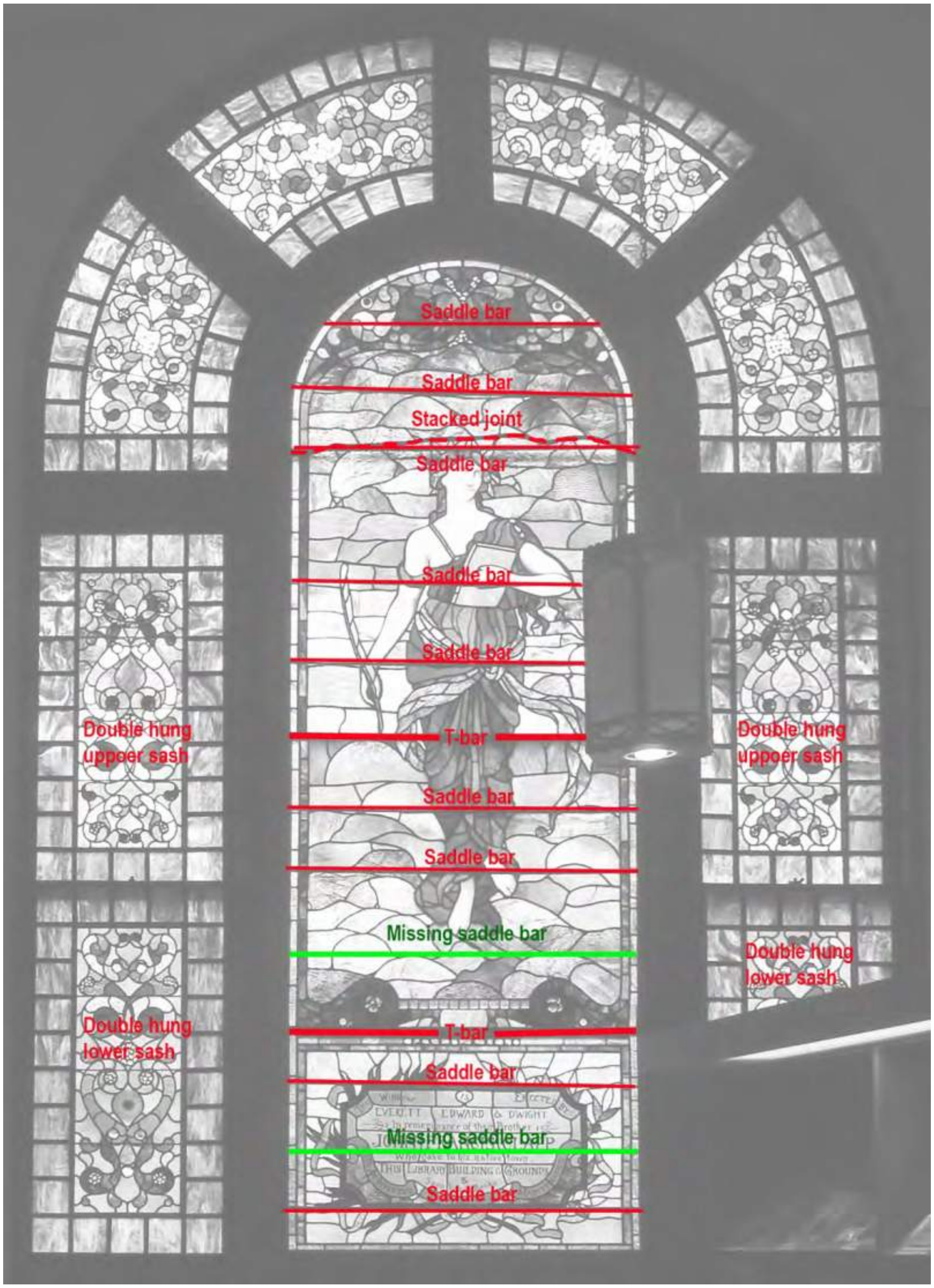

Saddle bar
Saddle bar
Stacked joint
Saddle bar
Saddle bar
Saddle bar
Double hung uppoer sash
T-bar
Double hung uppoer sash
Saddle bar
Saddle bar
Missing saddle bar
Double hung lower sash
Double hung lower sash
T-bar
Saddle bar
Missing saddle bar
Saddle bar

EXHIBIT D

CODE REVIEW

Applicable Codes

2009 International Building Code

2009 International Existing Building Code

2009 International Mechanical Code

2009 International Energy Conservation Code

Massachusetts Amendments

Board of Fire Prevention Regulations (527 CMR)

Board of State Examiners of Plumbers an Gas Fitters (248 CMR)

Massachusetts Electrical Code (527 CMR 12.00)

Architectural Access Board (521 CMR)

ICC A117.1-3 Accessible and Usable Buildings and Facilities

Occupancy Use: Assembly A-3

State Building Code Review

Chapter 34: Existing Structures

3401.1 Scope. Chapter 34 of the International Building Code 2009 is deleted in its entirety. The alteration, repair, addition, and change of occupancy of existing buildings shall be controlled by the provisions of the **International Existing Building Code 2009** and its appendices, and as modified with Massachusetts Amendments.

Chapter 11: Accessibility

1101.1 Scope. In accordance with MGL c.22, paragraph 13A, all public buildings shall be designed to be accessible to, and functional for use by, physically disabled persons, and conform to the requirements of 521 CMR…which shall be enforced by the building official or the state inspector, as applicable.

521 CMR: Architectural Access Board (effective July 27, 2006)

3.00: Jurisdiction

3.9 Historic Buildings

An historic building or facility that is listed or is eligible for listing in the National or State Register of Historic Places or is designated as historic under appropriate state or local laws may be granted a variance by the Board to allow alternate accessibility. If a variance is requested on the basis of historical significance, then consultation with the Massachusetts Historical Commission is required in order to determine whether a building or facility is eligible for listing or listed in the National or State Register of Historic Places. The Massachusetts Historical Commission may request a copy of the proposed variance request and supporting documentation to substantiate the variance request and its effect on historic resources. A written statement from the Massachusetts Historical Commission is required with the application for variance.

International Existing Building Code 2009 (IEBC)

For the purposes of this study, the 2009 International Existing Building Code will serve as the basis for code review. This code allows historic properties, those recognized as such by the State or National Register of Historic Places, some flexibility as far as full compliance with current codes. Any new construction must meet current code however. Section 308, Historic Buildings, states that "the provisions of this code relating to the construction, repair, alteration, addition, restoration and movement of structures, and change of occupancy shall not be mandatory for historic buildings where such buildings are judged by the building official to not constitute a distinct life safety hazard".

The codes will require compliance to the greatest extent possible to provide the following with regard to universal access.

- At least one accessible building entrance
- At least one accessible route from an accessible building entrance to primary function areas.
- Signage complying with Section 1110 of the International Building Code.
- Accessible parking, where parking is being provided.
- At least one accessible passenger loading zone, when loading zones are provided.
- At least one accessible route connecting accessible parking and accessible passenger loading zones to an accessible entrance.
- Where toilet rooms are provided, the room shall comply with the standards for an accessible family or assisted-use toilet room. The toilet room shall be on an accessible route.

All of these accessibility requirements have been achieved within the existing building to the greatest extent possible. The requirement for vertical access utilizing a Limited Use/Limited Access (LULA) lift rather than a full sized elevator was acceptable in the past and installed. However, the LULA installed in 1999 is no longer operable and should be replaced in order for the Library to be fully compliant.

The International Existing Building Code devotes Chapter 11 to Historic Buildings and how these buildings may be repaired or altered in a safe way that allows for reuse of the building. The major points of this chapter include the following:

1. Section 1101.2: The code official shall determine if a report by a design professional is required to show that safety features are in compliance with the intent of this code. This may entail a study of load paths through the building with regard to seismic design, and it may "demonstrate how the intent of these provisions is complied with in providing an equivalent level of safety."
2. Section 1102 Repairs: Repairs to any portion of a historic building or structure shall be permitted with original or like materials and original methods of construction, subject to certain provisions.
3. Section 1102.5 Replacement: Replacement of existing or missing features using original materials shall be permitted. Partial replacement for repairs that match the original in configuration, height, and size shall be permitted. Safety glazing is the exception which requires full compliance with the International Building Code.
4. Section 1103 Fire Safety: Historic buildings undergoing alterations, changes of occupancy, or that are moved shall comply with Section 1103. Section 1103.12 further states: "Every historical building that cannot be made to conform to the construction requirements specified in the International Building Code for the occupancy or use, and that constitutes a distinct fire hazard shall be deemed to be in compliance if provided with an approved automatic fire extinguishing system." The code official may approve an alternative life-safety system.

It is envisioned the majority of work recommended in this report will consist of repairs to the existing structure. No additions are envisioned at this time, and alterations will consist of the inclusion of accessible features and repair of historic features with in-kind materials. As such, the IEBC allows for the following:

Repairs: Repairs shall be done in a manner that maintains the level of fire protection, of protection provided for the means of egress, and the level of accessibility.

Alterations: Alterations shall comply with the requirements of the International Building Code for new construction.

In summary, the IEBC allows for certain flexibility with regard to historic buildings such as the Clapp Memorial Library. Compliance with universal accessibility provisions is achievable given repairs and the creation of a plan to provide alternatives to full physical access.

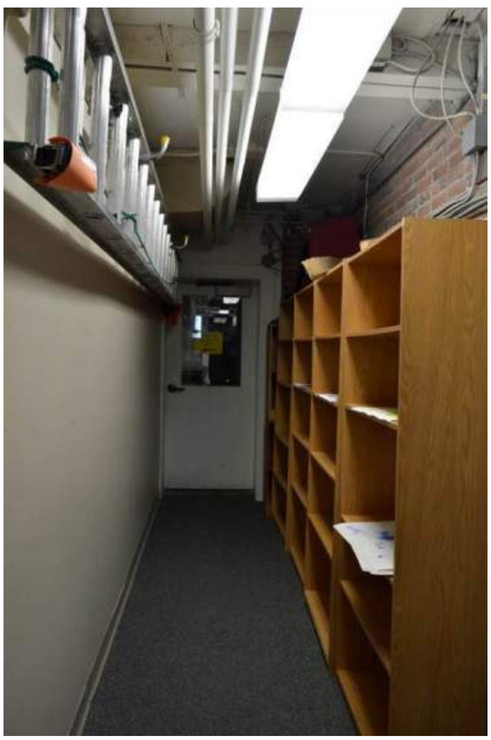
Accessibility

A van accessible parking space has been provided as required by code. The sign should be upgraded to show the latest code language and lines and symbols should be repainted.

An accessible route from the parking space has been created via a ramping system to the lower level of the building.

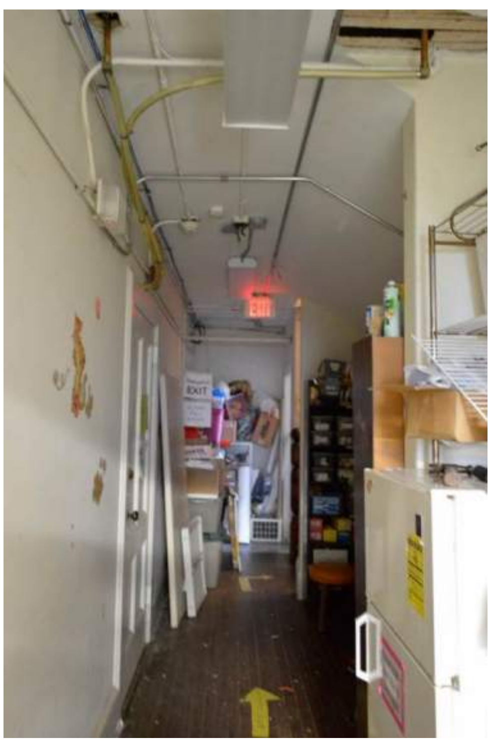
An automatic door at the base of the ramp provides access to the interior. Even as it does not meet the strict letter of the law as far as opening width, it provides access within the spirit of the law.

A Limited Use/Limited Access lift provides access to the main library level. Installed in 1999, it is no longer functional and should be replaced.

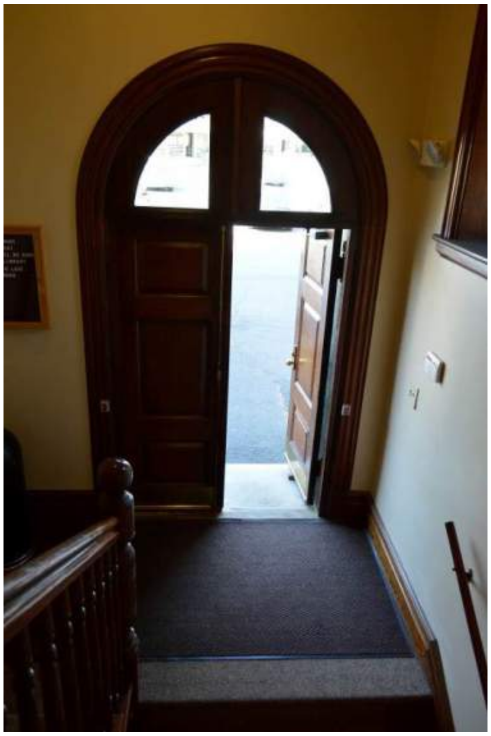


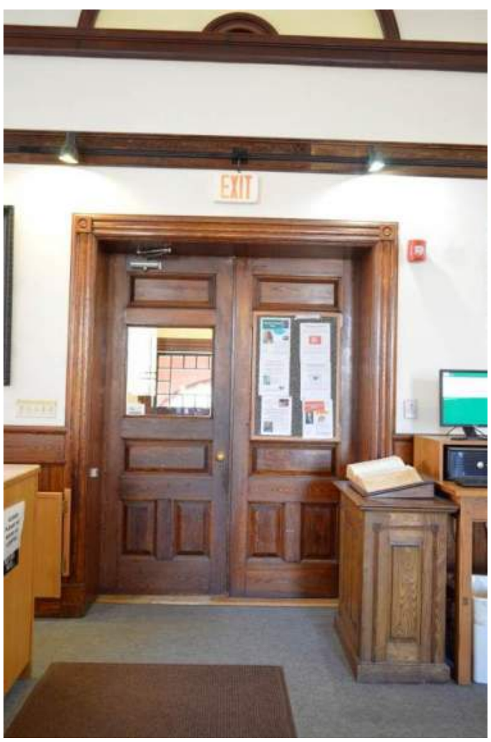
The corridor to a Children's Activity Classroom is the minimum width required for accessibility. There is no space for a wheel chair to turn in the corridor in order to enter the classroom on the right at the end of the array of bookcases. The bookcases should be removed and relocated.

The door to the Children's Activity Classroom is not outfitted with a lever handle classroom lockset as required by Universal Accessibility codes. The door is permitted to swing in rather than out into the egress corridor since the room occupancy is less than 50 persons.



Access to the second means of egress within the lower level is obstructed by stored items within the corridor. The building code requires that egress corridors are kept clear at all times. Storage areas within a dedicated egress corridor are also a hazard. The storage nook on the left side of the photo should be closed off from the egress corridor with a fire rated wall and door system.





The primary entrance on the north side of the building adjacent to the parking area consists of a pair of 2'-6" double doors with one operable leaf and one fixed leaf. These are the original wood paneled doors which are significant, character defining features of the building. Strictly according to code, each leaf of the doors should be 36" wide. Door hardware is also non-compliant. An egress door should have a panic bar to allow for quick opening in an emergency. There is also the desire on the part of the library to add a vision panel to this pair of doors. The west facing entrance doors could provide a model for this idea.

The doors at the west entrance appear to be original and show a panel configuration that accommodates a panic bar and a vision panel. The door operating hardware should include a panic bar in favor of the knob handle.

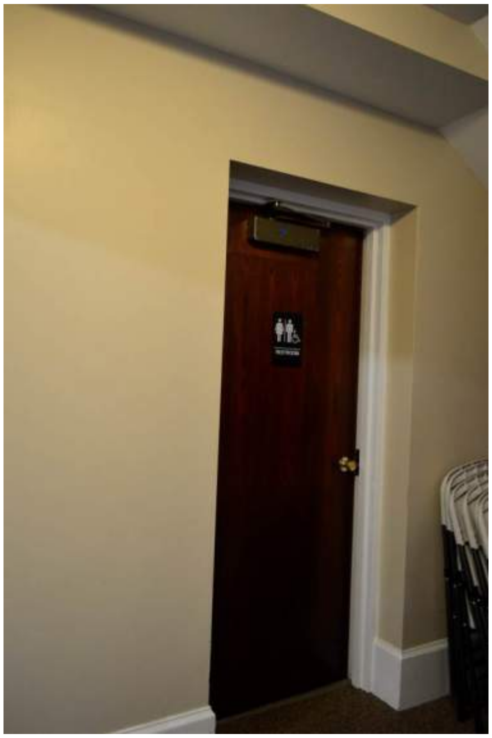
The west vestibule entrance does not comply with current codes as the staircase ends directly in front of the exit doors. Current code requires a landing as deep as the staircase at the base of the stair. A landing in this location is technically infeasible without altering the historic fabric of the building. The past addition of a second handrail closer to the door jamb is an additional safety improvement.

The staircase to the Children's Area has a steeper rise and a narrower tread than allowed by current code. The narrow tread is particularly problematic as the limited dimension does not allow for firm footing for an adult. The staircase could be rebuilt to mimic the current form and direction while altering the rise and run to be more comfortable and code compliant.

Note the three stop LULA in the background that allows for access to the Children's Area. The LULA will need to be replaced.

The area between stacks at the main level is 24 inches wide and is not wide enough to accommodate Universal Accessibility at 32 inches minimum. The shelving on the left could be altered to remove the deeper lower shelves. Alternatively, the central shelving units on the right could be altered to provide only one shelf deep. Either option loses necessary stack room and modifies the historic fabric.

Structurally, the mezzanine level stacks require further structural assessment to determine if they can be loaded to modern standards. Unfortunately, access to the stacks is by way of a narrow, 24 inch wide staircase that is awkward to use. At present, the mezzanine stacks are modestly used for storage of library materials and are not accessible to the public. This limited storage system should remain in place with access to the mezzanine only by authorized personnel.



The lower level accessible toilet room meets code for the most part, but the knob handle should be swapped out for a code compliant lever handle.

EXHIBIT E

SECRETARY OF THE INTERIORS STANDARDS FOR THE RESTORATION OF HISTORIC PROPERTIES

1. A property will be used as it was historically or be given a new use which reflects the property's restoration period.

2. Materials and features from the restoration period will be retained and preserved. The removal of materials or alteration of features, spaces, and spatial relationships that characterize the period will not be undertaken.

3. Each property will be recognized as a physical record of its time, place, and use. Work needed to stabilize, consolidate and conserve materials and features from the restoration period will be physically and visually compatible, identifiable upon close inspection, and properly documented for future research.

4. Materials, features, spaces, and finishes that characterize other historical periods will be documented prior to their alteration or removal.

5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize the restoration period will be preserved.

6. Deteriorated features from the restoration period will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials.

7. Replacement of missing features from the restoration period will be substantiated by documentary and physical evidence. A false sense of history will not be created by adding conjectural features, features from other properties, or by combining features that never existed together historically.

8. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.

9. Archeological resources affected by a project will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.

10. Designs that were never executed historically will not be constructed.

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