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Case Study

Emma Willard School

An Overview of the extraordinary window restoration project at Emma Willard School—the largest of its kind in the United States.

Through the Glass, Darkly

An Overview of the extraordinary window restoration project at Emma Willard School—the largest of its kind in the United States. **E**mma Willard is a school in good hands. The Board of Trustees is involved and informed by an active Alumnae Council and institutional leadership that include Head of School Trudy Hall and a superior team of administrators. Ian Smith, the Director of Facilities, is directly responsible for the Window Restoration Project.

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Introduction

The campus of Emma Willard School is a visual gem sitting atop a hill overlooking Troy, New York, a city built by prosperous entrepreneurs during the latter half of the 19th century. It is the present day home of the nation's oldest secondary school for girls, and carries on the tradition of leadership in women's education begun in 1814 by its founder, Emma Hart Willard. The school has made its home in Troy since 1821, where it was first known as the Troy Female Seminary until the name was changed to honor its founder in 1895. The existing buildings were designed by the important Troy architect, Fredrick M. Cummings, and built in the first decade of the 20th century, in the Collegiate Gothic style. This style borrows heavily from the soaring cathedral buildings with elegant ornament that were built throughout Europe during the Gothic period.

The architects and master builders of Emma Willard's Mount Ida campus shared a common vision. Through their efforts, threads of carved stone, sheets of slate, brilliant copper, wood, lead, and glass were woven together to form a magnificent architectural tapestry that has elegantly served past and present students of Emma Willard, and has received national recognition for its outstanding architectural quality. The fenestration program, a major component of the campus architecture, is richly executed, comprising wood windows glazed with leaded glass and plain glazing; steel windows glazed with leaded glass; and stone set panels of leaded and stained glass. The individual panels are fabricated and the stone-set windows are installed employing materials and methods little changed over the past millennium.

Leaded, multi-paned windows contribute greatly to the character of the buildings and the ambience of the campus. Each panel of glass is set at a slightly different angle than those around it, resulting in a jewel-like quality of reflection and refraction of light. Due to the ravages of time and the elements, the windows had deteriorated to a serious state of disrepair. Replacement with modern aluminum windows appeared to be the only option open to the school. After much consideration of the importance of the windows, the leadership and board of the school determined that saving and restoring these windows is critical to the maintenance of the present exterior esthetic. This white paper will describe the unique approach taken at Emma Willard to restore their historic windows.

The Problem

The windows at Emma Willard were built by talented craftsmen from top quality materials. They had long suffered from freeze thaw cycles, ultraviolet radiation from the sun and the intrusion of water from rain and melting snow. These forces had destroyed the protective layer of paint and had leached out the natural oils of the wood frames and sashes. The lead came matrices of the windows had succumbed to metal fatigue caused by the constant movement of the metal in response to expansion and contraction forces. Some of the glass had broken as the windows deflected beyond what the tensile strength of the glass could bear.

There are over 3,600 windows throughout the campus of the Emma Willard School and all of them required attention. Window projects of this scale are typically executed by removing 100 to 150 windows at a time. This is the standard way to achieve a level of efficiency to provide a good value for the client. Unfortunately, this can also result in the loss of the use of the rooms where windows have been removed. This was not an option for Emma Willard, because it makes use of all of its

spaces throughout the school year. A new window restoration paradigm had to be developed for this project.

Figure 1-Typical wood and leaded glass window before restoration

The Project

In 1993, prior to the involvement of Femenella & Associates with the project, the School had the prestigious firm of Mesick Cohen Waite Architects completed an extensive survey of the windows on the campus. In 2001, we were called in to review and update the survey. Femenella & Associates performed close inspections of numerous representative windows on all of the elevations of the buildings to ascertain if and to what extent the windows had further deteriorated. The bad news was that the windows had continued to deteriorate. The good news is that the windows were originally fabricated from high-quality materials by highly skilled craftsmen. The windows are still at a point in their lives where they can be restored to their original style and beauty. During this phase, we also did a number of tests for hazardous materials and paint and finish analyses to determine the original colors and materials employed.

Forgetting for the moment the great esthetic value and ambience that the windows imbue on the facades and interiors of the buildings and campus, it is important to remember that it is far more cost effective to restore the existing windows than to try to replicate them from new materials. Further, they don't grow trees like they used to. Today's trees are engineered to grow as fast as possible, maximizing yield per acre. Forced growing results in trees with less growth rings per inch producing lumber that is less resistant to rot and attack by insects, and more prone to twist and warp. Old growth trees, such as the trees from which the wood employed at Emma Willard was milled, have many more growth rings per inch due to their slower growth. This results in lumber that stays straight and true, and is more resistant to damage from the onslaught of wind and weather. The properly restored existing windows of Emma Willard will greatly outlast the highest-quality new replacement windows at less than half the cost.

During the prototype phase, we restored a number of typical windows representing the different styles and types of windows on campus and their varying levels of deterioration. We took numerous paint samples and determined the original, and subsequent, paint colors used on the windows. This empowered the administration to set the level of quality desired during the construction phase for details and finish; to determine the level of operability offering the best compromise between function and cost; and to make decisions regarding a host of options such as color and style of finish, type of storm windows, hardware, etc. The prototype phase also provided information regarding man-hours per window and quantities of materials needed to complete the construction phase of the project.

Emma Willard has begun the construction phase of the work, embarking on the largest window restoration project attempted to date in the United States, including 3,600 windows, many of which contain multiple glazed sections. We have restored 70% of the extensive collection of windows on the campus. The difference in performance and the aesthetic appreciation of the windows is dramatic.

To maximize the efficiency of the project while minimizing its impact on the students, we suggested a new paradigm for large window restoration projects to the board of directors of the school. Rather than remove large amounts of windows off site, we mentioned to the director of the school that we saw some buildings on the campus that appeared to be underutilized. One of these was an old horse stable. We provided a plan to renovate the stable into an onsite restoration studio. The stable has been renovated and now serves the needs of the school in a most efficient way. This new approach allows workers to remove small groups of windows, not more than 20 at a time, and still do the work in a cost-effective manner; the windows never leave the site. We also convinced the school to purchase custom scaffolding that is designed for the project. This has saved the school tens of thousands of dollars in rentals.

The work is currently being completed by our trained conservators. As we move through towards the completion of the project at the site, apprentices from the Troy area and/or the present staff of Emma Willard will be integrated into the program to learn the skills necessary to properly restore historic windows. The intention is for these apprentices to then become staff carpenters and begin to do more of the work. Ultimately, the onsite staff will shoulder the full responsibility of the restoration and long-term maintenance of the windows.

Figure 2-Window after restoratio

The Process

Prior to staring removals at the site, the number of windows to be restored for the upcoming year is determined through meetings with Ian Smith, Director of Facilities, and his staff. Photographic elevations of the buildings are marked up and spread sheets produced that informs all interested parties of exactly when building access will be required and all mile stone dates for each window to be restored during the season. Once we are all in agreement, notices are sent to the staff with copies of the colored coded work plans.

Most of the buildings at Emma Willard are three to four stories high. The scaffold is set to cover a twenty foot wide section of the building and set to the highest elevation. All of the windows in this column are removed. The window openings are temporarily boarded up with a combination of painted plywood and acrylic to allow light into the interior spaces. As the windows are removed, identifying numbers are stamped into the edges of the sash and the moldings. All hardware is bagged and tagged. Everything is transported to the shop.

The sashes are deglazed and the glass is separated from the old lead. All lead is recycled. The paint and interior finishes are removed from the wood sash. Old weather stripping is removed and recycled. Where necessary, many of the sashes are separated into pieces for rejoining and gluing. We have a large wood shop in Philadelphia. All moldings and sash members that must be replaced are fabricated at this shop from Spanish cedar.

As much of the original fabric as possible is saved. We use Dutchman repairs where needed fabricated from old growth eastern white pine. Areas of deterioration not requiring Dutchman repairs were consolidated and filled with epoxy products specifically designed d for the is purpose. After sanding of the repairs and epoxy patches, the sash were given two coats of a "natural" consolidant, boiled linseed oil, spar varnish and a water repellant. The exterior was painted with an oil base primer and two topcoats of latex paint. The interior was a bit more complex, receiving a copy of the original 7 step faux finish to mimic dark oak. The frames were treated in a similar manner as the sash.

A big goal of the project was to make the windows more thermally efficient. To this end, we did the following. The upper sashes were made fixed; not permanently so, nothing was done that was irreversible. This allowed for the caulking of the upper sash and made the upper connection at the meeting rail immovable, resulting in a better seal at the meeting rail weather stripping. New integral weather stripping was installed. The weather strip is fabricated from spring bronze and the receiving strip on the sash is lined with heavy felt virtually eliminating all infiltration.

For the leaded glass, a lead alloy contain copper, tin and antimony will greatly extend the life of the lead came matrix. To further support the matrix (some of the panels are very large and exceed the recommended maximum size) we augmented the original support system. Originally, the panels had a series of horizontal flat bars soldered onto the panels and let into the sash at the perimeter. We amended this system to include an internal steel bar at every horizontal lead that runs full width of the panel and a series of applied flat bars that run vertically and are let into the sash at the perimeter of the panels. To effect this change, we did not use the original glass because each piece would have to be trimmed 1/8" to allow for the internal bars. We had determined early on in the project in consensus with the staff of the school that the individual pieces of glass were not as important as the overall aesthetic that the multi-paned windows afforded the building. The glass was highly polished, had no visual movement and was perfectly copied with new glass. These panels were set into a flexible caulk system.

Figure 3-Stone set stained glass windows after restoration

The Future

If all our plans are realized, the onsite window restoration workshop will become a learning center for the school. Seminars will be held in which school windows will be repaired and seminar attendees will learn the proper techniques of wood window and leaded glass restoration. This would provide skilled labor for the restoration of the complete building fabric of the campus and add to the profit potential of the workshop. Every effort will be made to include students of Emma Willard in the project.

In the final analysis, the Window Restoration Project will serve to restore architectural treasures and educate the public in a cost-effective manner. I look forward to working with alumnae and parents in our workshops.

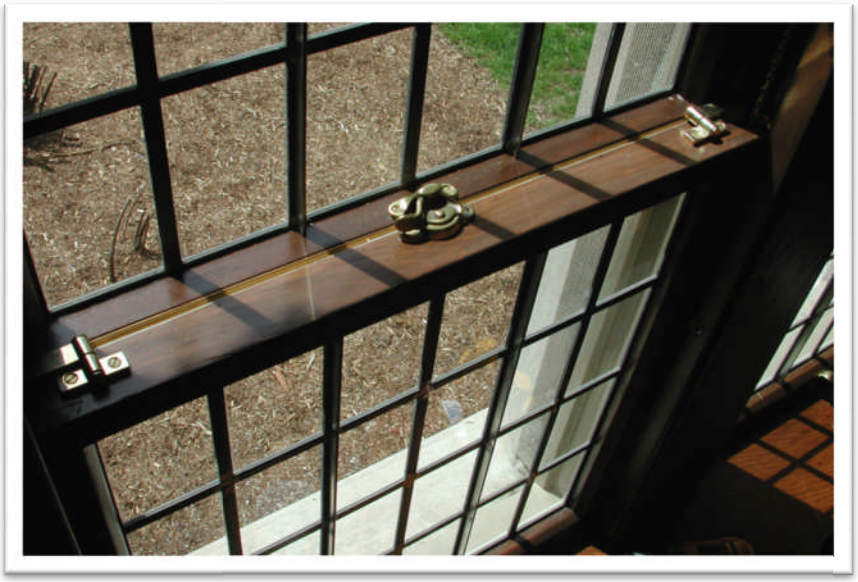

Figure 4-Wood double hung after restoration, interior view

About Femenella & Associates

Arthur Femenella is the President of Femenella & Associates, Inc., a full service stained glass and historic window conservation studio. Mr. Femenella began as an apprentice in 1968 at the Greenland Studio of New York and later became co-owner. In 1993 he formed Femenella & Associates. The firm has expanded to include historic wood and steel window restoration. He has been responsible for the restoration of thousands of windows, doors, panels and artifacts, including hundreds of works by John La Farge, Louis Comfort Tiffany, Frank Lloyd Wright, Maitland Armstrong, Mary Tillinghast and other artists of equal importance. Mr. Femenella is active in a number of preservation groups. He has written numerous articles and lectures across the country. The firm is an approved provider of AIA/CES learning credits.

Mr. Femenella is a founder, past President and current Vice-President of the American Glass Guild, LLC; a past Chair of the Restoration Committee, former Board Member and former Treasurer of the Stained Glass Association of America. In this capacity, Mr. Femenella was the primary author of the booklet *Standards and Guidelines for the Preservation of Historic Stained Glass Windows*. Mr. Femenella sat on the Board of Governors of the Census of Stained Glass Windows in America, and was the primary author of the technical section of the booklet produced by the Census titled, *The Conservation of Historic Stained Glass: An Owner's Guide*. He is a member of APTI, the National Trust and the AIC, with a pending application for Professional Associate status.

Arthur Femenella has written over forty articles on subjects specific to stained glass and historic window restoration. He has presented papers at numerous international and national symposiums and conferences. Art was the consultant to the Protective Glazing Task Force. This was a group of architects, engineers, and preservationists charged by the Department of the Interior to develop national guidelines for the fabrication and installation of protective glazing.

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