DEPARTMENT OF COMMUNITY DEVELOPMENT SERVICES

Planning Division

m e m o r a n d u m

TO: Laurel Lunt Prussing, Mayor

FROM: Elizabeth H. Tyler, Ph.D., FAICP, Director

DATE: July 3, 2013

SUBJECT: 1404 S. Lincoln Avenue (Zeta Tau Alpha Sorority House). Case No. HP 2013-L-01

Introduction

At its June 17, 2013 meeting, the Urbana City Council reviewed an application to designate the Zeta Tau Alpha Sorority House at 1404 S. Lincoln Ave. as a local historic landmark under Article XII of the Urbana Zoning Ordinance. Following a City staff report, public input was taken from both supporters and opponents of the application. In speaking at that meeting, the property owner represented that designation of the Zeta Tau Alpha House as a local landmark would ultimately hinder rehabilitation of the property by imposing additional costs. Following public input, the Urbana City Council sent the application to the July 8, 2013 Committee of the Whole meeting for further consideration. Specifically, Councilmember Smyth asked City staff to advise the Council on potentially amending the draft landmark ordinance with waivers or conditions to grant pre-approval to replace the Zeta Tau Alpha's existing windows and roofing material. This memorandum is intended to offer guidance on this question.

Background

Historic Preservation Case No. HP 2013-L-01 is an application by Briana Kraft of Lena, Illinois to designate the Zeta Tau Alpha Sorority House as a municipal historic landmark under Article XII of the Urbana Zoning Ordinance. The owner of record is Zeta Tau Alpha Fraternity of Indianapolis, Indiana.

At the June 5, 2013 Historic Preservation Commission (HPC) meeting, the HPC held a public hearing, reviewed the application in terms of the landmark criteria, and recommended that the City Council approve the application. Please refer to your June 17, 2013 City Council packet for a report, application and supporting documentation, owner objection with rebutting evidence, communications from the public, and Historic Preservation Commission meeting minutes and recommendation. Those materials are expressly referenced here as forming the basis for recommended actions.

Because the property owner timely filed a written protest with the City Clerk, approval of this landmark application would require a two-thirds majority of all Councilmembers holding office.

Should the application be approved, the owner would be required to obtain a Certificate of Appropriateness from the City for future alterations that affect the exterior architectural appearance of the structure, including demolition of the structure.

Discussion

The City Attorney, in a June 18, 2013 memorandum, provided the Mayor and City Council with a legal opinion that amending the draft landmark ordinance with waivers or conditions is legally permissible under Illinois law. However, the City Council should consider the likely outcomes of creating such an exemption, including:

1. Undermining the integrity of the Historic Preservation Ordinance;
2. Creating a precedent and raising expectations to exempt other landmark applications from certain aspects of the Certificate of Appropriateness process;
3. Loss of control over the quality and character of the exempted work;
4. Creating an impression that the owners of existing landmark properties are being treated inconsistently or even unfairly;
5. Circumventing the Certificate of Economic Hardship process before a property owner has made a specific proposal would be highly speculative and without the benefit of evidence of economic hardship.

Building Condition

The Zeta Tau Alpha House until 2009 was occupied and annually inspected by the City of Urbana housing inspectors for compliance with the University of Illinois' Certified Housing program. In 2009, the building was vacated. The out-of-state property owners have subsequently employed a local property manager for the purpose of insuring that the property remains secure and that the exterior complies with minimum maintenance standards. Since 2009, the owners have annually registered the ZTA House under the City of Urbana's vacant structures registry.

The building has been secured by boarding up first floor windows on the inside of the structure and maintaining an automatic fire alarm. The building does not have fire sprinklers, and to reoccupy the building a fire sprinkler system would need to be installed, as has been previously required for occupancy of all dormitories and Greek houses in Urbana. Although the building is unoccupied, nothing in the City's property maintenance records indicate that the building is in a hazardous or dangerous condition, and no City inspection reports indicate that the building is structurally unsound. Code enforcement letters issued since 2009 have involved broken window glass, vegetation, and debris. At the Fire Department's request, the owners have removed interior refuse to reduce the risk of fire. The Urbana Police Department periodically responds to reports that the building has been entered illegally, after which the property manager has secured the openings.

Certificates of Appropriateness Process

When the owners of landmarked properties choose to make exterior changes and improvements to their property, the proposed work will be reviewed and approved either administratively or by the Historic Preservation Commission, depending on the extent of the work. Table XII-1 of the Zoning Ordinance specifies the level of review carried out for different projects. Most exterior maintenance and repairs in kind are either exempt from review or are reviewed administratively for consistency with the Historic Preservation Ordinance. Only significant exterior changes are reviewed by the Historic Preservation Commission. For instance, repairing and even replacing roofing with like materials and design is reviewed and approved by City staff and the Commission Chair. The Historic Preservation Commission reviews exterior changes such as: building additions, changes in roof lines and roof cladding, covering or replacing original siding, replacing historic windows and doors, new construction, and demolition.

The Urbana Historic Preservation Commission works with applicants to accommodate changes in ways that are both financially reasonable and in keeping with the property's historic character. Since 2000, the City has received 48 applications for Certificates of Appropriateness. Of these, 23 were reviewed administratively and 25 were reviewed by the Historic Preservation Commission. Of the total 48 applications, 46 (96%) were approved.

Certificate of Economic Hardship Process

Under the Fifth Amendment to the U.S. Constitution, government action cannot take property for public use without just compensation. With the 1922 Supreme Court decision in Pennsylvania Coal Co. v. Mahon, the doctrine of a *regulatory* taking was first established, but not until 1978 did a Supreme Court ruling establish the grounds for what constituted a regulatory taking. In the 1978 decision Penn Central Transportation Co. v. City of New York, the U.S. Supreme Court upheld the City's municipal historic preservation ordinance as Constitutional and provided a test for what constitutes a regulatory taking. In that decision, the Court determined that while property owners should be able to expect a reasonable economic return and reasonable beneficial use of the property, a government taking has not occurred simply because the property owner could otherwise earn more money. And in 1992, the Supreme Court further defined regulatory takings by ruling in Lucas v. South Carolina Coastal Council that a categorical government taking occurs when all economically beneficial use of the property is denied.

In the case of the Zeta Tau Alpha Sorority House, there is no evidence that designating the property as a municipal landmark would in any way constitute a taking as the owners could continue using the property for the range of uses allowed in the R-7 (University Residential) zoning district. And where strict application of the Historic Preservation Ordinance would be unusually burdensome on the owner, the Ordinance offers relief through an economic hardship process. Through issuance of a Certificate of Economic Hardship (Section XII-6.D of the Zoning Ordinance), property owners demonstrating that the application of the landmark standards impose an economic hardship can be approved for alternative improvements or even demolition of the property. The City of Urbana's factors for determining whether a hardship has been imposed (Section XII-6.D.4) incorporate the findings of the Illinois Supreme Court in the 1998 case Zaruba v. Village of Oak Park. These include:

- Whether a substantial decrease in the fair market value of property has occurred as a result of the denial of the certificate;
- The structural soundness of any structures on the property and their suitability for rehabilitation;
- The economic feasibility of rehabilitation and reuse of the structure; and,
- The cost of the proposed construction, alteration, relocation or demolition.

Lacking overwhelming evidence to the contrary, representations of economic hardship are best taken into account once the property owner makes specific proposals and through the Certificate of Economic Hardship process. The City Council can hear and decide upon appeals for denial of Certificates of Appropriateness and Certificates of Economic Hardship. Since 2000, the City Council has reviewed one Certificate of Economic Hardship case (2008-EH-01) and which was ultimately decided in favor of the applicant.

Windows & Roofing

Under the Secretary of Interior's Standards for Rehabilitation, which have been adopted by the Urbana Historic Preservation Commission, the first consideration for treatment of historic windows is repair rather than replacement, but if replacement is necessary, replacement in kind is preferred. Almost all the existing windows in the Zeta Tau Alpha House are rolled steel casement windows with divided light glass panes. From a cursory review of the windows facing Vermont Street, the existing windows appear to be repairable by arresting rust, sanding, priming and painting the metal; replacing broken window panes and loose putty; and repairing or replacing broken hardware or non-repairable windows. Please see the attached National Park Service Brief No. 13: The Repair and Thermal Upgrading of Historic Steel Windows.

To improve the windows' energy efficiency, caulking, weather stripping, and adding thermal glazing are the most common strategies for steel windows. Adding thermal glazing might include mounting Lexan with gaskets to the exterior window frame, or attaching interior storm windows to the inside of the steel frame with magnetic strips and caulking around the edges (but leaving weep holes to allow any condensation between the glass to evaporate).

The City's Property Maintenance Code would require insect screens to be installed for the building to be reoccupied. For casement windows opening outward, operable screens would need to be fabricated and installed on the interior. For casement windows opening inward, fixed screens could be installed on the outside. Because window screens are relatively inexpensive to fabricate, their installation could cost more than fabrication.

In City staff's experience, a detailed assessment can identify the proper and most cost effective treatment for historic window repairs. It has been our experience that repairing sound metal windows will usually cost far less than replacement. For instance, in a 2004 cost analysis for replacement of all the bronze single-pane casement windows in the St. Joseph, Missouri City Hall with aluminum triple-paned casement windows, the payback period for increased energy efficiency was determined to be nearly 100 years. In that case, the City of St. Joseph proceeded to have the windows repaired, reglazed, and weather stripped for a fraction of the replacement costs. In that case funds were instead allocated to replace their building's aged boiler, which cut the building's natural gas consumption in half, and to balance the radiator system to improve comfort and reduce energy consumption.

In reviewing requests by property owners to replace windows and roofing materials, the Historic Preservation Commission has been able to both uphold rehabilitation standards and meet the property owners' needs. In July 2010, the Commission approved an application (HP Case No. 2010-COA-03) by the owner of the Tiernan's Block Building (115 W Main Street) to replace six traditional wood windows, determined to be beyond repair, with new windows matching the original window sizes and profiles. In December 2010, the Historic Preservation Commission approved an application (HP Case No. 2010-COA-06) by the owner of the Urbana-Lincoln Hotel to replace the original 1922 fibrous (asbestos) cement roof shingles with an architectural asphalt roof shingle of reasonably similar appearance from the ground.

An important reason why City staff recommends against exempting the replacement of windows and roofing from review is that it would mean loss of control over the quality and character of the exempted work. In the case of the Zeta Tau Alpha House, the existing steel windows form an important component of the building's architectural character. As an example of how window replacement can substantially alter the character of a building, the following recent example is provided for the former Phi Beta Chi Sorority house located at 1004 S. Lincoln Avenue which is not a designated Urbana landmark. In this case, the 1924 steel casement windows were replaced with double hung vinyl windows. While steel casement windows when maintained can last well over a century, inexpensive vinyl residential windows can be expected to last 15 to 20 years before replacement will be necessary.

1004 S. Lincoln Ave. -- Before

1004 S. Lincoln Ave. – After

Alpha Rho Chi House Rehabilitation

Since the June 17, 2013 City Council meeting, City staff received the attached communication from Christopher Enck, an architectural engineer who works on façade restoration projects in Chicago. Mr. Enck also indicates that he is an officer of the organization managing the Alpha Rho Chi House at 1108 S First Street in Champaign, which not only has the same design as the Zeta Tau Alpha House, but was likewise designed by Joseph Royer's firm. According to Mr. Enck, the Alpha Rho Chi Fraternity has managed to maintain and restore its house on a very tight budget as well as update the building to a level of comfort expected by today's students. He states that Alpha Rho Chi has been able to maintain the same original steel windows and clay tile roofing that the Zeta Tau Alpha House has in Urbana. Mr. Enck indicates he strongly favors designation as an Urbana landmark and that it should not be viewed as hindering building

improvement. And Mr. Enck has offered his technical assistance and advice for rehabilitation of the Zeta Tau Alpha House.

Recommendation

City staff requests that the Committee of the Whole take into account the information provided in this memo as part of the consideration to designate 1404 S. Lincoln Avenue (Zeta Tau Alpha Sorority House) as a local historic landmark.

At the June 5, 2013 Historic Preservation Commission meeting, and following the conclusion of the public hearing, the Commission voted 6-ayes and 0-nayes to recommend that the City Council **APPROVE** the Zeta Tau Alpha Sorority House landmark application (Case No. HP 2013-L-01). City staff likewise recommends that the Committee of the Whole forward the application to the City Council for approval, along with the following separate advisory motion:

> *Should the windows and roof cladding on the Zeta Tau Alpha House be determined to be so deteriorated that they cannot be repaired and must be replaced, City staff and/or the Historic Preservation Commission shall work closely with the property owner to offer reasonable accommodations in reviewing and issuing Certificates of Appropriateness for the necessary repairs and replacements.*

Prepared by:

Robert Myers

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Robert Myers, AICP, Planning Manager

R. Bird

_____

Rebecca Bird, AICP, Planner II

Attachments:

- Draft ordinance
- Preservation Brief No. 13: Repair and Thermal Upgrading of Historic Steel Windows
- Communication

cc: Anne Tamulaitis
Matt Deering
Collen Ramais

ORDINANCE NO. 2013-06-054

AN ORDINANCE DESIGNATING A HISTORIC LANDMARK

(1404 South Lincoln Avenue, "Zeta Tau Alpha Sorority House"
Historic Preservation Case No. HP2013-L-01)

WHEREAS, the City of Urbana, a home rule municipality, is authorized to designate local landmarks and historic districts under 5 ILCS 5/11-48.2-2 et seq of the Illinois Municipal Code, and under Article XII (Historic Preservation) of the Urbana Zoning Ordinance; and

WHEREAS, Article XII of the Urbana Zoning Ordinance provides the City of Urbana the authority to designate local landmarks and historic districts with the stated purpose to promote the educational, cultural, economic, and general welfare of the community; and

WHEREAS, Brianna Kraft has nominated the property located at 1404 South Lincoln Avenue, Urbana (commonly referred to as the "Zeta Tau Alpha Sorority House") to be designated a historic landmark pursuant to the Urbana Historic Preservation Ordinance; and

WHEREAS, the owner of the subject property, Zeta Tau Alpha Fraternity, has been duly notified of the nomination and has submitted a valid protest against the nomination; and

WHEREAS, after due publication and notice to all parties as is required under the Historic Preservation Ordinance and the Illinois Municipal Code, a public hearing was held by the Urbana Historic Preservation Commission on June 5, 2013 concerning the subject historic landmark nomination; and

WHEREAS, following the public hearing, the Historic Preservation Commission voted to recommend to the Urbana City Council landmark designation for the subject parcel by a vote of 6 ayes and 0 nays; and

WHEREAS, the owner of the subject parcel was notified of the date of the public hearing and the date of the City Council meeting at which the designation is to be considered.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF URBANA, ILLINOIS, as follows:

Section 1. The Council does hereby find and determine, based upon the recommendation of the Historic Preservation Commission, that the subject parcel should be designated as a historic landmark on the basis of meeting the following criteria in Section XII-5.C.1:

Criteria a) Significant value as part of the architectural, cultural, educational, and social heritage of the community as an outstanding example of the role that Greek life has historically played on the University of Illinois campus, which is recognized as having the largest university Greek system of any American university;

Criteria c) Representative of the distinguishing characteristics of the French Eclectic Architectural Style and is inherently valuable for the study of that style, as well as for its craftsmanship, and that additionally the Zeta Tau Alpha Sorority House retains a high degree of integrity;

Criteria d) Notable work of Joseph Royer, a master architect whose individual genius has greatly influenced Urbana and Central Illinois; and

Criteria e) Identifiable as an established and familiar visual feature in the community owing to its uniquely prominent and picturesque roofline, rich use of materials and architectural details indicative of the French Eclectic Architectural Style, and visibility from Lincoln Avenue, an arterial roadway which defines the eastern edge of campus; and

thus, the said structure at 1404 South Lincoln Avenue, commonly referred to as the “Zeta Tau Alpha Sorority House”, is hereby designated as a historic landmark, pursuant to Article XII of the Zoning Ordinance of the City of Urbana, Illinois.

LEGAL DESCRIPTION:

Lots Sixty-Three (63), Sixty-Four (64), Sixty-Five (65) and Sixty-Six (66) in University Heights Addition to Urbana, being a part of the Southwest Quarter (SW ¼) of the Southwest Quarter (SW ¼) of Section Seventeen (17), Township Nineteen (19) North, Range Nine (9) East of the Third Principal Meridian, in Champaign County, Illinois.

Said property being commonly known as 1404 South Lincoln Avenue, Urbana, Illinois and having Permanent Identification Number of: 93-21-17-352-005.

Section 2. The City Clerk is hereby directed to publish this Ordinance in pamphlet form by authority of the City Council of the City of Urbana. This Ordinance shall be in full force and effect from and after its passage and publication in accordance with the terms of Chapter 65, Article 11, Division 13 (Zoning) of the Illinois Compiled Statutes (65 ILCS 5/11-13-14).

PASSED by a two-thirds majority of the Urbana City Council this _____ day of _____, 2013.

AYES:

NAYS:

ABSTAINS:

_____
Phyllis D. Clark, City Clerk

APPROVED by the Mayor this _____ day of _____, 2013.

_____
Laurel Lunt Prussing, Mayor

CERTIFICATE OF PUBLICATION IN PAMPHLET FORM

I, Phyllis D. Clark, certify that I am the duly elected and acting Municipal Clerk of the City of Urbana, Champaign County, Illinois. I certify that on the _____ day of _____, 2013, the City Council of the City of Urbana passed and approved Ordinance No. _____, entitled AN ORDINANCE DESIGNATING A HISTORIC LANDMARK (1404 South Lincoln Avenue, "Zeta Tau Alpha Sorority House" Historic Preservation Case No. HP2013-L-01) which provided by its terms that it should be published in pamphlet form. The pamphlet form of Ordinance No. _____ was prepared, and a copy of such Ordinance was posted in the Urbana City Building commencing on the _____ day of _____, 2013, and continuing for at least ten (10) days thereafter. Copies of such Ordinance were also available for public inspection upon request at the Office of the City Clerk.

DATED at Urbana, Illinois, this _____ day of _____, 2013.

13 PRESERVATION BRIEFS

The Repair and Thermal Upgrading of Historic Steel Windows

Sharon C. Park, AIA

U.S. Department of the Interior
National Park Service
Cultural Resources
Heritage Preservation Services

The Secretary of the Interior's "Standards for Rehabilitation" require that where historic windows are individually significant features, or where they contribute to the character of significant facades, their distinguishing visual qualities must not be destroyed. Further, the rehabilitation guidelines recommend against changing the historic appearance of windows through the use of inappropriate designs, materials, finishes, or colors which radically change the sash, depth of reveal, and muntin configuration; the reflectivity and color of the glazing; or the appearance of the frame.

Windows are among the most vulnerable features of historic buildings undergoing rehabilitation. This is especially the case with rolled steel windows, which are often mistakenly not deemed worthy of preservation in the conversion of old buildings to new uses. The ease with which they can be replaced and the mistaken assumption that they cannot be made energy efficient except at great expense are factors that typically lead to the decision to remove them. In many cases, however, repair and retrofit of the historic windows are more economical than wholesale replacement, and all too often, replacement units are unlike the originals in design and appearance. If the windows are important in establishing the historic character of the building (see fig. 1), insensitively designed replacement windows may diminish—or destroy—the building's historic character.

This *Brief* identifies various types of historic steel windows that dominated the metal window market from 1890-1950. It then gives criteria for evaluating deterioration and for determining appropriate treatment, ranging from routine maintenance and weatherization to extensive repairs, so that replacement may be avoided where possible.[1] This information applies to do-it-yourself jobs and to large rehabilitations where the volume of work warrants the removal of all window units for complete overhaul by professional contractors.

This *Brief* is not intended to promote the repair of ferrous metal windows in every case, but rather to insure that preservation is always the first consideration in a rehabilitation project. Some windows are not important elements in defining a building's historic character; others are highly significant, but so deteriorated that repair is infeasible. In such cases, the *Brief* offers guidance in evaluating appropriate replacement windows.

Fig. 1 Often highly distinctive in design and craftsmanship, rolled steel windows play an important role in defining the architectural character of many later nineteenth and early twentieth century buildings. Art Deco, Art Moderne, the International Style, and Post World War II Modernism depended on the slim profiles and streamlined appearance of metal windows for much of their impact. Photo: William G. Johnson.

[1]The technical information given in this brief is intended for most ferrous (or magnetic) metals, particularly rolled steel. While stainless steel is a ferrous metal, the cleaning and repair techniques outlined here must not be used on it as the finish will be damaged. For information on cleaning stainless steel and non-ferrous metals, such as bronze, Monel, or aluminum, refer to *Metals in America's Historic Buildings* (see bibliography).

HISTORICAL DEVELOPMENT

Although metal windows were available as early as 1860 from catalogues published by architectural supply firms, they did not become popular until after 1890. Two factors combined to account for the shift from wooden to metal windows about that time. Technology borrowed from the rolling industry permitted the mass production of rolled steel windows. This technology made metal windows cost competitive with conventional wooden windows. In addition, a series of devastating urban fires in Boston, Baltimore, Philadelphia, and San Francisco led to the enactment of strict fire codes for industrial and multi-story commercial and office buildings.

As in the process of making rails for railroads, rolled steel windows were made by passing hot bars of steel through progressively smaller, shaped rollers until the appropriate angled configuration was achieved (see fig. 2). The rolled steel sections, generally 1/8'' thick and 1'' - 1 1/2'' wide, were used for all the components of the windows: sash, frame,and subframe (see fig. 3). With the addition of wire glass, a fire-resistant window resulted. These rolled steel windows are almost exclusively found in masonry or concrete buildings.

A byproduct of the fire-resistant window was the strong metal frame that permitted the installation of larger windows and windows in series. The ability to have expansive amounts of glass and increased ventilation dramatically changed the designs of late 19th and early 20th century industrial and commercial buildings.

The newly available, reasonably priced steel windows soon became popular for more than just their fire-resistant qualities. They were standardized, extremely durable, and easily transported. These qualities led to the use of steel windows in every type of construction, from simple industrial and institutional buildings to luxury commercial and apartment buildings. Casement, double-hung, pivot, projecting, austral, and continuous windows differed in operating and ventilating capacities. Figure 4 outlines the kinds and properties of metal windows available then and now. In addition, the thin profiles of metal windows contributed to the streamlined appearance of the Art Deco, Art Moderne, and International Styles, among others.

The extensive use of rolled steel metal windows continued until after World War II when cheaper, non-corroding aluminum windows became increasingly popular. While aluminum windows dominate the market today, steel windows are still fabricated. Should replacement of original windows become necessary, replacement windows may be available from the manufacturers of some of the earliest steel windows. Before an informed decision can be made whether to repair or replace metal windows, however, the significance of the windows must be determined and their physical condition assessed.

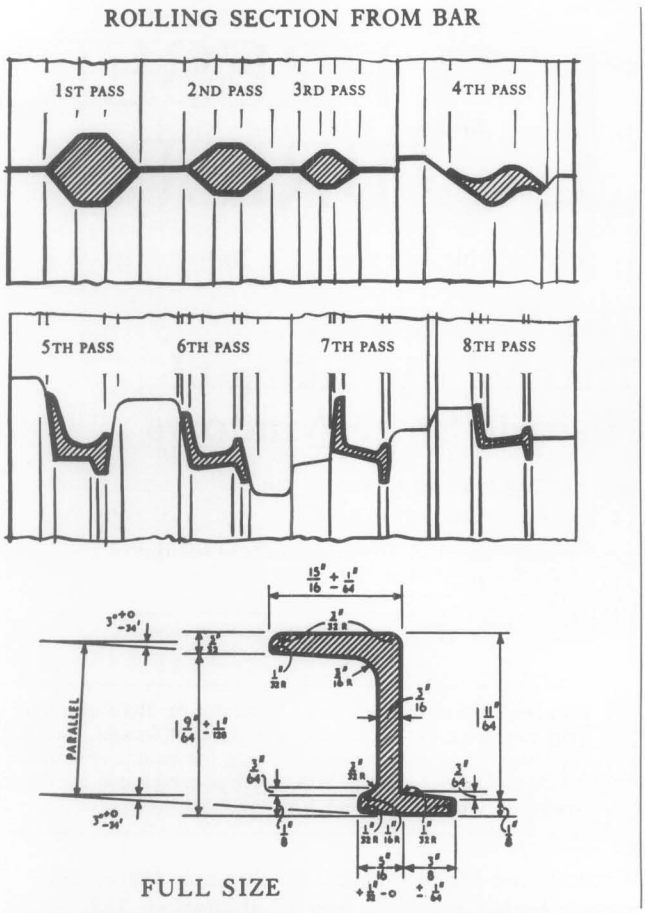


Fig. 2. The process of rolling a steel bar into an angled section is illustrated above. The shape and size of the rolled section will vary slightly depending on the overall strength needed for the window opening and the location of the section in the assembly: subframe, frame, or sash. The 1/8 '' thickness of the metal section is generally standard. Drawing: A Metal Window Dictionary. Used with permission.

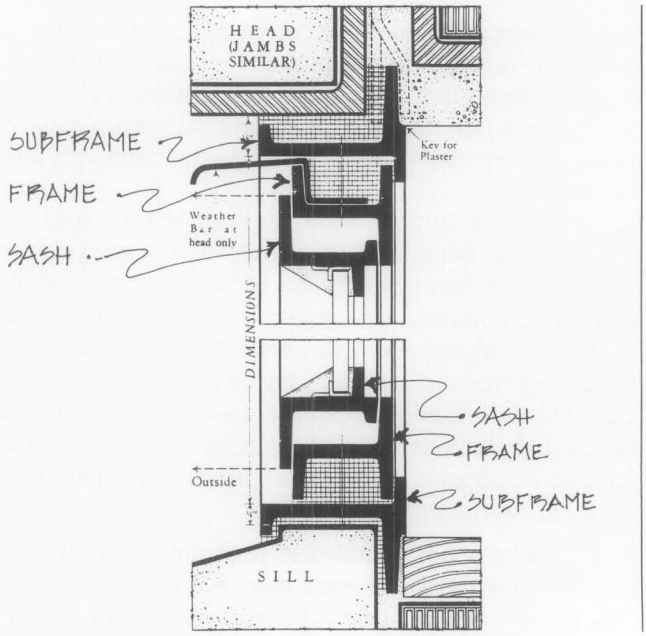


Fig. 3 A typical section through the top and bottom of a metal window shows the three component parts of the window assembly: subframe, frame, and sash. Drawings: Catalogue No. 15, January 1931; International Casement Co, Inc., presently Hope's Architectural Products, Inc., Jamestown, NY. Used with permission.

Cover illustration: from *Hope's Metal Windows and Casements: 1818-1926,* currently Hope's Architectural Products, Inc. Used with permission.

EVALUATION

Historic and Architectural Considerations

An assessment of the significance of the windows should begin with a consideration of their function in relation to the building's historic use and its historic character. Windows that help define the building's historic character should be preserved even if the building is being converted to a new use. For example, projecting steel windows used to introduce light and an effect of spaciousness to a warehouse or industrial plant can be retained in the conversion of such a building to offices or residences.

Other elements in assessing the relative importance of the historic windows include the design of the windows and their relationship to the scale, proportion, detailing and architectural style of the building. While it may be easy to determine the aesthetic value of highly ornamented windows, or to recognize the importance of streamlined windows as an element of a style, less elaborate windows can also provide strong visual interest by their small panes or projecting planes when open, particularly in simple, unadorned industrial buildings (see fig. 5).

One test of the importance of windows to a building is to ask if the overall appearance of the building would be changed noticeably if the windows were to be removed or radically altered. If so, the windows are important in defining the building's historic character, and should be repaired if their physical condition permits.

Physical Evaluation

Steel window repair should begin with a careful evaluation of the physical condition of each unit. Either drawings or photographs, liberally annotated, may be used to record the location of each window, the type of operability, the condition of all three parts—sash, frame and subframe—and the repairs essential to its continued use.

Specifically, the evaluation should include: presence and degree of corrosion; condition of paint; deterioration of the metal sections, including bowing, misalignment of the sash, or bent sections; condition of the glass and glazing compound; presence and condition of all hardware, screws, bolts, and hinges; and condition of the masonry or concrete surrounds, including need for caulking or resetting of improperly sloped sills.

Corrosion, principally rusting in the case of steel windows, is the controlling factor in window repair; therefore, the evaluator should first test for its presence. Corrosion can be light, medium, or heavy, depending on how much the rust has penetrated the metal sections. If the rusting is merely a surface accumulation or flaking, then the corrosion is light. If the rusting has penetrated the metal (indicated by a bubbling texture), but has not caused any structural damage, then the corrosion is medium. If the rust has penetrated deep into the metal, the corrosion is heavy. Heavy corrosion generally results in some form of structural damage,through delamination, to the metal section, which must then be patched or spliced. A sharp probe or tool, such as an ice pick, can be used to determine the extent of corrosion in the metal. If the probe can penetrate the surface of the metal and brittle strands can be dug out, then a high degree of corrosive deterioration is present.

In addition to corrosion, the condition of the paint, the presence of bowing or misalignment of metal sections, the amount of glass needing replacement, and the condition of the masonry or concrete surrounds must be assessed in the evaluation process. These are key factors in determining whether or not the windows can be repaired in place. The more complete the inventory of existing conditions, the easier it will be to determine whether repair is feasible or whether replacement is warranted.

Rehabilitation Work Plan

Following inspection and analysis, a plan for the rehabilitation can be formulated. The actions necessary to return windows to an efficient and effective working condition will fall into one or more of the following categories: routine maintenance, repair, and weatherization. The routine maintenance and weatherization measures described here are generally within the range of do-it-yourselfers. Other repairs, both moderate and major, require a professional contractor. Major repairs normally require the removal of the window units to a workshop, but even in the case of moderate repairs, the number of windows involved might warrant the removal of all the deteriorated units to a workshop in order to realize a more economical repair price. Replacement of windows should be considered only as a last resort.

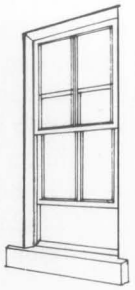
Since moisture is the primary cause of corrosion in steel windows, it is essential that excess moisture be eliminated and that the building be made as weathertight as possible before any other work is undertaken. Moisture can accumulate from cracks in the masonry, from spalling mortar, from leaking gutters, from air conditioning condensation runoff, and from poorly ventilated interior spaces.

Finally, before beginning any work, it is important to be aware of health and safety risks involved. Steel windows have historically been coated with lead paint. The removal of such paint by abrasive methods will produce toxic dust. Therefore, safety goggles, a toxic dust respirator, and protective clothing should be worn. Similar protective measures should be taken when acid compounds are used. Local codes may govern the methods of removing lead paints and proper disposal of toxic residue.

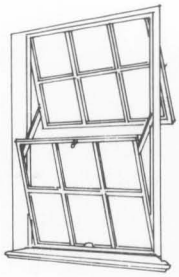
ROUTINE MAINTENANCE

A preliminary step in the routine maintenance of steel windows is to remove surface dirt and grease in order to ascertain the degree of deterioration, if any. Such minor cleaning can be accomplished using a brush or vacuum followed by wiping with a cloth dampened with mineral spirits or denatured alcohol.

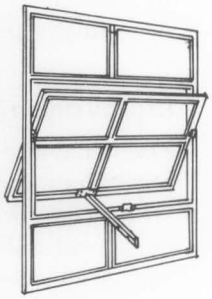
Double-hung industrial windows duplicated the look of traditional wooden windows. Metal double-hung windows were early examples of a building product adapted to meet stringent new fire code requirements for manufacturing and high-rise buildings in urban areas. Soon supplanted in industrial buildings by less expensive pivot windows, double-hung metal windows regained popularity in the 1940s for use in speculative suburban housing.



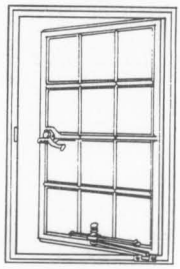
Austral windows were also a product of the 1920s. They combined the appearance of the double-hung window with the increased ventilation and ease of operation of the projected window. (When fully opened, they provided 70% ventilation as compared to 50% ventilation for double-hung windows.) Austral windows were often used in schools, libraries and other public buildings.



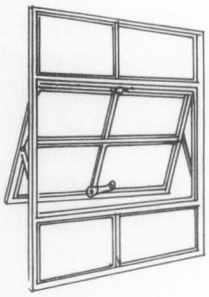
Pivot windows were an early type of industrial window that combined inexpensive first cost and low maintenance. Pivot windows became standard for warehouses and power plants where the lack of screens was not a problem. The window shown here is a horizontal pivot. Windows that turned about a vertical axis were also manufactured (often of iron). Such vertical pivots are rare today.



Casement windows adapted the English tradition of using wrought iron casements with leaded cames for residential use. Rolled steel casements (either single, as shown, or paired) were popular in the 1920s for cottage style residences and Gothic style campus architecture. More streamlined casements were popular in the 1930s for institutional and small industrial buildings.



Projecting windows, sometimes called awning or hopper windows, were perfected in the 1920s for industrial and institutional buildings. They were often used in "combination" windows, in which upper panels opened out and lower panels opened in. Since each movable panel projected to one side of the frame only, unlike pivot windows, for example, screens could be introduced.



Continuous windows were almost exclusively used for industrial buildings requiring high overhead lighting. Long runs of clerestory windows operated by mechanical tension rod gears were typical. Long banks of continuous windows were possible because the frames for such windows were often structural elements of the building.

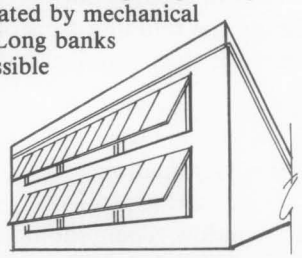


Fig. 4 Typical rolled steel windows available from 1890 to the present. The various operating and ventilating capacities in combination with the aesthetics of the window style were important considerations in the selection of one window type over another. Drawings: Sharon C. Park, AIA.

If it is determined that the windows are in basically sound condition, the following steps can be taken: 1) removal of light rust, flaking and excessive paint; 2) priming of exposed metal with a rust-inhibiting primer; 3) replacement of cracked or broken glass and glazing compound; 4) replacement of missing screws or fasteners; 5) cleaning and lubrication of hinges; 6) repainting of all steel sections with two coats of finish paint compatible with the primer; and 7) caulking the masonry surrounds with a high quality elastomeric caulk.

Recommended methods for removing light rust include manual and mechanical abrasion or the application of chemicals. Burning off rust with an oxy-acetylene or propane torch, or an inert gas welding gun, should never be attempted because the heat can distort the metal. In addition, such intense heat (often as high as 3800° F) vaporizes the lead in old paint, resulting in highly toxic fumes. Furthermore, such heat will likely result in broken glass. Rust can best be removed using a wire brush, an aluminum oxide sandpaper, or a variety of power tools

Fig. 5 Windows often provide a strong visual element to relatively simple or unadorned industrial or commercial buildings. This design element should be taken into consideration when evaluating the significance of the windows. Photo: Michael Auer.

adapted for abrasive cleaning such as an electric drill with a wire brush or a rotary whip attachment. Adjacent sills and window jambs may need protective shielding.

Rust can also be removed from ferrous metals by using a number of commercially prepared anti-corrosive acid compounds. Effective on light and medium corrosion, these compounds can be purchased either as liquids or gels. Several bases are available, including phosphoric acid, ammonium citrate, oxalic acid and hydrochloric acid. Hydrochloric acid is generally not recommended; it can leave chloride deposits, which cause future corrosion. Phosphoric acid-based compounds do not leave such deposits, and are therefore safer for steel windows. However, any chemical residue should be wiped off with damp cloths, then dried immediately. Industrial blow-dryers work well for thorough drying. The use of running water to remove chemical residue is never recommended because the water may spread the chemicals to adjacent surfaces, and drying of these surfaces may be more difficult. Acid cleaning compounds will stain masonry; therefore plastic sheets should be taped to the edge of the metal sections to protect the masonry surrounds. The same measure should be followed to protect the glazing from etching because of acid contact.

Measures that remove rust will ordinarily remove flaking paint as well. Remaining loose or flaking paint can be removed with a chemical paint remover or with a pneumatic needle scaler or gun, which comes with a series of chisel blades and has proven effective in removing flaking paint from metal windows. Well-bonded paint may serve to protect the metal further from corrosion, and need not be removed unless paint build-up prevents the window from closing tightly. The edges should be feathered by sanding to give a good surface for repainting.

Next, any *bare* metal should be wiped with a cleaning solvent such as denatured alcohol, and dried immediately in preparation for the application of an anti-corrosive primer. Since corrosion can recur very soon after metal has been exposed to the air, the metal should be primed immediately after cleaning. Spot priming may be required periodically as other repairs are undertaken. Anti-corrosive primers generally consist of oil-alkyd based paints rich in zinc or zinc chromate.[2] Red lead is no longer available because of its toxicity. All metal primers, however, are toxic to some degree and should be handled carefully. Two coats of primer are recommended. Manufacturer's recommendations should be followed concerning application of primers.

REPAIR

Repair in Place

The maintenance procedures described above will be insufficient when corrosion is extensive, or when metal window sections are misaligned. Medium to heavy corrosion that has not done any structural damage to the metal sections can be removed either by using the chemical cleaning process described under "Routine Maintenance" or by sandblasting. Since sandblasting can damage the masonry surrounds and crack or cloud the glass, metal or plywood shields should be used to protect these materials. The sandblasting pressure should be low, 80-100 pounds per square inch, and the grit size should be in the range of #10-#45. Glass peening beads (glass pellets) have also been successfully used in cleaning steel sections. While sandblasting equipment comes with various nozzle sizes, pencil-point blasters are most useful because they give the operator more effective control over the direction of the spray. The small aperture of the pencil-point blaster is also useful in removing dried putty from the metal sections that hold the glass. As with any cleaning technique, once the bare metal is exposed to air, it should be primed as soon as possible. This includes the inside rabbeted section of sash where glazing putty has been removed. To reduce the dust, some local codes allow only wet blasting. In this case, the metal must be dried immediately, generally with a blow-drier (a step that the owner should consider when calculating the time and expense involved). Either form of sandblasting metal covered with lead paints produces toxic dust. Proper precautionary measures should be taken against toxic dust and silica particles.

Bent or bowed metal sections may be the result of damage to the window through an impact or corrosive expansion. If the distortion is not too great, it is possible to realign the metal sections without removing the window to a metal fabricator's shop. The glazing is generally removed and pressure is applied to the bent or bowed section. In the case of a muntin, a protective 2 x 4 wooden bracing can be placed behind the bent portion and a wire cable with a winch can apply progressively more pressure over several days until the section is realigned. The 2 x 4 bracing is necessary to distribute the pressure evenly over the damaged section. Sometimes a section, such as the bottom of the frame, will bow out as a result of pressure exerted by corrosion and it is often necessary to cut the metal section to relieve this pressure prior to pressing the section back into shape and making a welded repair.

Once the metal sections have been cleaned of all corrosion and straightened, small holes and uneven areas resulting from rusting should be filled with a patching material and sanded smooth to eliminate pockets where water can accumulate. A patching material of steel fibers and an epoxy binder may be the easiest to apply. This steel-based epoxy is available for industrial steel repair; it can also be found in auto body patching compounds or in plumber's epoxy. As with any product, it is important to follow the manufacturer's instructions for proper use and best results. The traditional patching technique—melting steel welding rods to fill holes in the metal sections—may be difficult to apply in some situations; moreover, the window glass must be removed during the repair process, or it will crack from the expansion of the heated metal sections. After these repairs, glass replacement, hinge lubrication, painting, and other cosmetic repairs can be undertaken as necessary.

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[2]Refer to Table IV. Types of Paint Used for Painting Metal in *Metals in America's Historic Buildings*, p. 139. (See bibliography).

To complete the checklist for routine maintenance, cracked glass, deteriorated glazing compound, missing screws, and broken fasteners will have to be replaced; hinges cleaned and lubricated; the metal windows painted, and the masonry surrounds caulked. If the glazing must be replaced, all clips, glazing beads, and other fasteners that hold the glass to the sash should be retained, if possible, although replacements for these parts are still being fabricated. When bedding glass, use only glazing compound formulated for metal windows. To clean the hinges (generally brass or bronze), a cleaning solvent and fine bronze wool should be used. The hinges should then be lubricated with a non-greasy lubricant specially formulated for metals and with an anti-corrosive agent. These lubricants are available in a spray form and should be used periodically on frequently opened windows.

Final painting of the windows with a paint compatible with the anti-corrosive primer should proceed on a dry day. (Paint and primer from the same manufacturer should be used.) Two coats of finish paint are recommended if the sections have been cleaned to bare metal. The paint should overlap the glass slightly to insure weathertightness at that connection. Once the paint dries thoroughly, a flexible exterior caulk can be applied to eliminate air and moisture infiltration where the window and the surrounding masonry meet.

Caulking is generally undertaken after the windows have received at least one coat of finish paint. The perimeter of the masonry surround should be caulked with a flexible elastomeric compound that will adhere well to both metal and masonry. The caulking used should be a type intended for exterior application, have a high tolerance for material movement, be resistant to ultraviolet light, and have a minimum durability of 10 years. Three effective compounds (taking price and other factors into consideration) are polyurethane, vinyl acrylic, and butyl rubber. In selecting a caulking material for a window retrofit, it is important to remember that the caulking compound may be covering other materials in a substrate. In this case, some compounds, such as silicone, may not adhere well. Almost all modern caulking compounds can be painted after curing completely. Many come in a range of colors, which eliminates the need to paint. If colored caulking is used, the windows should have been given two coats of finish paint prior to caulking.

Repair in Workshop

Damage to windows may be so severe that the window sash and sometimes the frame must be removed for cleaning and extensive rust removal, straightening of bent sections, welding or splicing in of new sections, and reglazing. These major and expensive repairs are reserved for highly significant windows that cannot be replaced; the procedures involved should be carried out only by skilled workmen. (see fig. 6a—6f.)

As part of the orderly removal of windows, each window should be numbered and the parts labelled. The operable metal sash should be dismantled by removing the hinges; the fixed sash and, if necessary, the frame can then be unbolted or unscrewed. (The subframe is usually left in place. Built into the masonry surrounds, it can only be cut out with a torch.) Hardware and hinges should be labelled and stored together.

The two major choices for removing flaking paint and corrosion from severely deteriorated windows are dipping in a chemical bath or sandblasting. Both treatments require removal of the glass. If the windows are to be dipped, a phosphoric acid solution is preferred, as mentioned earlier. While the dip tank method is good for fairly evenly distributed rust, deep set rust may remain after dipping. For that reason, sandblasting is more effective for heavy and uneven corrosion. Both methods leave the metal sections clean of residual paint. As already noted, after cleaning has exposed the metal to the air, it should be primed immediately after drying with an anti-corrosive primer to prevent rust from recurring.

Sections that are seriously bent or bowed must be straightened with heat and applied pressure in a workshop. Structurally weakened sections must be cut out, generally with an oxy-acetylene torch, and replaced with sections welded in place and the welds ground smooth. Finding replacement metal sections, however, may be difficult. While most rolling mills are producing modern sections suitable for total replacement, it may be difficult to find an exact profile match for a splicing repair. The best source of rolled metal sections is from salvaged windows, preferably from the same building. If no salvaged windows are available, two options remain. Either an ornamental metal fabricator can weld flat plates into a built-up section, or a steel plant can mill bar steel into the desired profile.

While the sash and frame are removed for repair, the subframe and masonry surrounds should be inspected. This is also the time to reset sills or to remove corrosion from the subframe, taking care to protect the masonry surrounds from damage.

Missing or broken hardware and hinges should be replaced on all windows that will be operable. Salvaged windows, again, are the best source of replacement parts. If matching parts cannot be found, it may be possible to adapt ready-made items. Such a substitution may require filling existing holes with steel epoxy or with plug welds and tapping in new screw holes. However, if the hardware is a highly significant element of the historic window, it may be worth having reproductions made.

Following are illustrations of the repair and thermal upgrading of the rolled steel windows in a National Historic Landmark (fig. 6). Many of the techniques described above were used during this extensive rehabilitation. The complete range of repair techniques is then summarized in the chart titled *Steps for Cleaning and Repairing Historic Steel Windows* (see fig. 7).

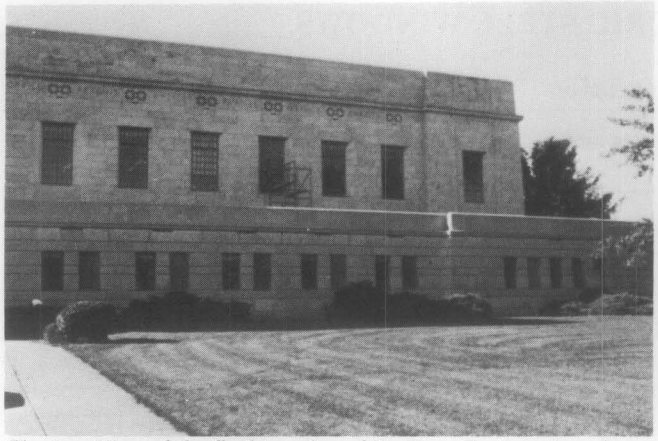

Fig. 6 a. View of the flanking wing of the State Capitol where the rolled steel casement windows are being removed for repair.

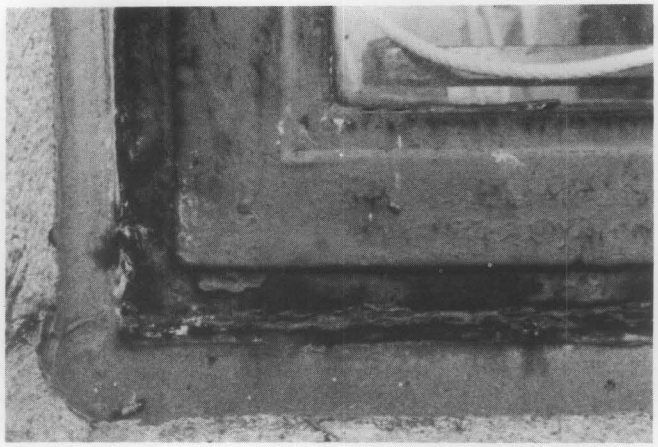

Fig. 6 b. View from the exterior showing the deteriorated condition of the lower corner of a window prior to repair. While the sash was in relatively good condition, the frame behind was rusted to the point of inhibiting operation.

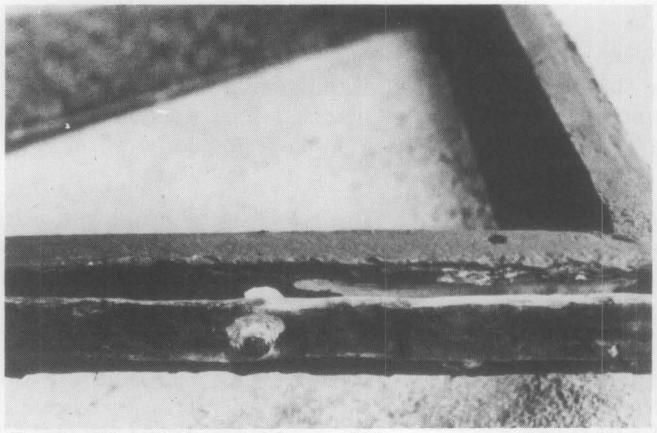

Fig. 6 c. View of the rusted frame which was unscrewed from the subframe and removed from the window opening and taken to a workshop for sandblasting. In some cases, severely deteriorated sections of the frame were replaced with new sections of milled bar steel.

Fig. 6 d. View looking down towards the sill. The subframes appeared very rusted, but were in good condition once debris was vacuumed and surface rust was removed, in place, with chemical compounds. Where necessary, epoxy and steel filler was used to patch depressions in order to make the subframe serviceable again.

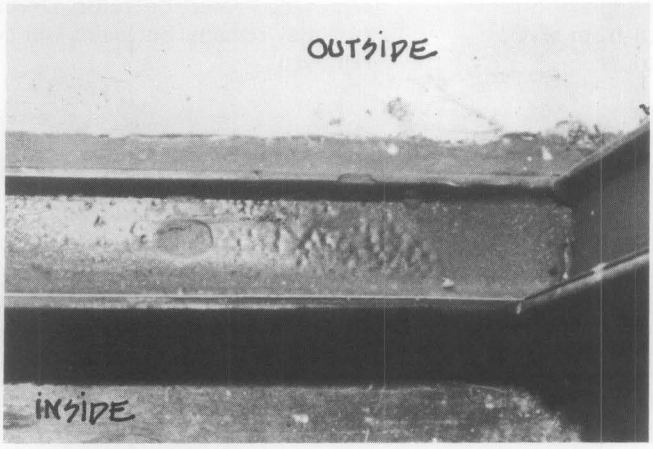

Fig. 6 e. View looking down towards the sill. The cleaned frame was reset in the window opening. The frame was screwed to the refurbished subframe at the jamb and the head only. The screw holes at the sill, which had been the cause of much of the earlier rusting, were infilled. Vinyl weatherstripping was added to the frame.

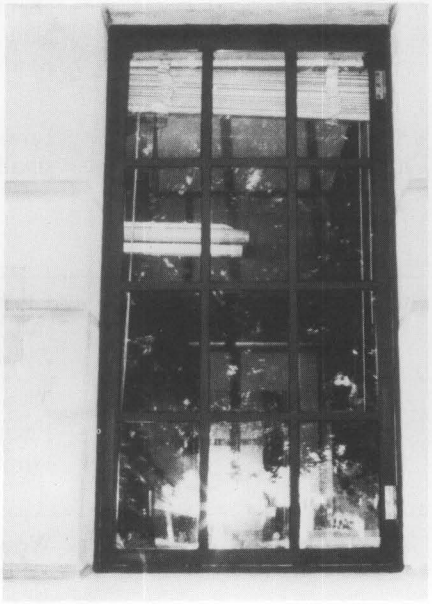

Fig. 6 f. View from the outside of the completely refurbished window. In addition to the steel repair and the installation of vinyl weatherstripping, the exterior was caulked with polyurethane and the single glass was replaced with individual lights of thermal glass. The repaired and upgraded windows have comparable energy efficiency ratings to new replacement units while retaining the historic steel sash, frames and subframes.

Fig. 6. The repair and thermal upgrading of the historic steel windows at the State Capitol, Lincoln, Nebraska. This early twentieth century building, designed by Bertram Goodhue, is a National Historic Landmark. Photos: All photos in this series were provided by the State Building Division.

STEPS FOR CLEANING AND REPAIRING HISTORIC STEEL WINDOWS

Work Item	Recommended Techniques	Tools, Products and Procedures	Notes
	*(Must be done in a workshop)		
1. Removing dirt and grease from metal	General maintenance and chemical cleaning	Vacuum and bristle brushes to remove dust and dirt; solvents (denatured alcohol, mineral spirits), and clean cloths to remove grease.	Solvents can cause eye and skin irritation. Operator should wear protective gear and work in ventilated area. Solvents should not contact masonry. Do not flush with water.
2. Removing Rust/ Corrosion			
Light	Manual and mechanical abrasion	Wire brushes, steel wool, rotary attachments to electric drill, sanding blocks and disks.	Handsanding will probably be necessary for corners. Safety goggles and masks should be worn.
	Chemical cleaning	Anti-corrosive jellies and liquids (phosphoric acid preferred); clean damp cloths.	Protect glass and metal with plastic sheets attached with tape. Do not flush with water. Work in ventilated area.
Medium	Sandblasting/abrasive cleaning	Low pressure (80-100 psi) and small grit (#10-#45); glass peening beads. Pencil blaster gives good control.	Removes both paint and rust. Codes should be checked for environmental compliance. Prime exposed metal promptly. Shield glass and masonry. Operator should wear safety gear.
Heavy	*Chemical dip tank	Metal sections dipped into chemical tank (phosphoric acid preferred) from several hours to 24 hours.	Glass and hardware should be removed. Protect operator. Deepset rust may remain, but paint will be removed.
	*Sandblasting/ abrasive cleaning	Low pressure (80-100 psi) and small grit (#10-#45).	Excellent for heavy rust. Remove or protect glass. Prime exposed metal promptly. Check codes for environmental compliance. Operator should wear safety gear.
3. Removing flaking paint.	Chemical method	Chemical paint strippers suitable for ferrous metals. Clean cloths.	Protect glass and masonry. Do not flush with water. Have good ventilation and protection for operator.
	Mechanical abrasion	Pneumatic needle gun chisels, sanding disks.	Protect operator; have good ventilation. Well-bonded paint need not be removed if window closes properly.
4. Aligning bent, bowed metal sections	Applied pressure	Wooden frame as a brace for cables and winch mechanism.	Remove glass in affected area. Realignment may take several days.
	*Heat and pressure	Remove to a workshop. Apply heat and pressure to bend back.	Care should be taken that heat does not deform slender sections.

Work Item	Recommended Techniques	Tools, Products and Procedures	Notes
	*(Must be done in a workshop)		
5. Patching depressions	Epoxy and steel filler	Epoxy fillers with high content of steel fibers; plumber's epoxy or autobody patching compound.	Epoxy patches generally are easy to apply, and can be sanded smooth. Patches should be primed.
	Welded patches	Weld in patches using steel rods and oxy-acetylene torch or arc welder.	Prime welded sections after grinding connections smooth.
6. Splicing in new metal sections	*Cut out decayed sections and weld in new or salvaged sections	Torch to cut out bad sections back to 45° joint. Weld in new pieces and grind smooth.	Prime welded sections after grinding connection smooth.
7. Priming metal sections	Brush or spray application	At least one coat of anti-corrosive primer on bare metal. Zinc-rich primers are generally recommended.	Metal should be primed as soon as it is exposed. If cleaned metal will be repaired another day, spot prime to protect exposed metal.
8. Replacing missing screws and bolts	Routine maintenance	Pliers to pull out or shear off rusted heads. Replace screws and bolts with similar ones, readily available.	If new holes have to be tapped into the metal sections, the rusted holes should be cleaned, filled and primed prior to redrilling.
9. Cleaning, lubricating or replacing hinges and other hardware	Routine maintenance, solvent cleaning	Most hinges and closure hardware are bronze. Use solvents (mineral spirits), bronze wool and clean cloths. Spray with non-greasy lubricant containing anti-corrosive agent.	Replacement hinges and fasteners may not match the original exactly. If new holes are necessary, old ones should be filled.
10. Replacing glass and glazing compound	Standard method for application	Pliers and chisels to remove old glass, scrape putty out of glazing rabbet, save all clips and beads for reuse. Use only glazing compound formulated for metal windows.	Heavy gloves and other protective gear needed for the operator. All parts saved should be cleaned prior to reinstallation.
11. Caulking masonry surrounds	Standard method for application	Good quality (10 year or better) elastomeric caulking compound suitable for metal.	The gap between the metal frame and the masonry opening should be caulked; keep weepholes in metal for condensation run-off clear of caulk.
12. Repainting metal windows	Spray or brush	At least 2 coats of paint compatible with the anti-corrosive primer. Paint should lap the glass about 1/8" to form a seal over the glazing compound.	The final coats of paint and the primer should be from the same manufacturer to ensure compatibility. If spraying is used, the glass and masonry should be protected.

Fig. 7. STEPS FOR CLEANING AND REPAIRING HISTORIC STEEL WINDOWS. Compiled by Sharon C. Park, AIA.

WEATHERIZATION

Historic metal windows are generally not energy efficient; this has often led to their wholesale replacement. Metal windows can, however, be made more energy efficient in several ways, varying in complexity and cost. Caulking around the masonry openings and adding weatherstripping, for example, can be do-it-yourself projects and are important first steps in reducing air infiltration around the windows. They usually have a rapid payback period. Other treatments include applying fixed layers of glazing over the historic windows, adding operable storm windows, or installing thermal glass in place of the existing glass. In combination with caulking and weatherstripping, these treatments can produce energy ratings rivaling those achieved by new units.[3]

Weatherstripping

The first step in any weatherization program, caulking, has been discussed above under "Routine Maintenance." The second step is the installation of weatherstripping where the operable portion of the sash, often called the ventilator, and the fixed frame come together to reduce perimeter air infiltration (see fig. 8). Four types of weatherstripping appropriate for metal windows are spring-metal, vinyl strips, compressible foam tapes, and sealant beads. The spring-metal, with an integral friction fit mounting clip, is recommended for steel windows in good condition. The clip eliminates the need for an applied glue; the thinness of the material insures a tight closure. The weatherstripping is clipped to the inside channel of the rolled metal section of the fixed frame. To insure against galvanic corrosion between the weatherstripping (often bronze or brass), and the steel window, the window must be painted prior to the installation of the weatherstripping. This weatherstripping is usually applied to the entire perimeter of the window opening, but in some cases, such as casement windows, it may be best to avoid weatherstripping the hinge side. The natural wedging action of the weatherstripping on the three sides of the window often creates an adequate seal.

Vinyl weatherstripping can also be applied to metal windows. Folded into a "V" configuration, the material forms a barrier against the wind. Vinyl weatherstripping is usually glued to the frame, although some brands have an adhesive backing. As the vinyl material and the applied glue are relatively thick, this form of weatherstripping may not be appropriate for all situations.

Compressible foam tape weatherstripping is often best for large windows where there is a slight bending or distortion of the sash. In some very tall windows having closure hardware at the sash mid-point, the thin sections of the metal window will bow away from the frame near the top. If the gap is not more than 1/4", foam weatherstripping can normally fill the space. If the gap exceeds this, the window may need to be realigned to close more tightly. The foam weatherstripping comes either with an adhesive or plain back; the latter variety requires application with glue. Compressible foam requires more frequent replacement than either spring-metal or vinyl weatherstripping.

A fourth type of successful weatherstripping involves the use of a caulking or sealant bead and a polyethylene bond breaker tape. After the window frame has been thoroughly cleaned with solvent, permitted to dry, and primed, a neat bead of low modulus (firm setting) caulk, such as silicone, is applied. A bond breaker tape is then applied to the operable sash covering the metal section where contact will occur. The window is then closed until the sealant has set (2-7 days, depending on temperature and humidity). When the window is opened, the bead will have taken the shape of the air infiltration gap and the bond breaker tape can be removed. This weatherstripping method appears to be successful for all types of metal windows with varying degrees of air infiltration.

Since the several types of weatherstripping are appropriate for different circumstances, it may be necessary to use more than one type on any given building. Successful weatherstripping depends upon using the thinnest material adequate to fill the space through which air enters. Weatherstripping that is too thick can spring the hinges, thereby resulting in more gaps.

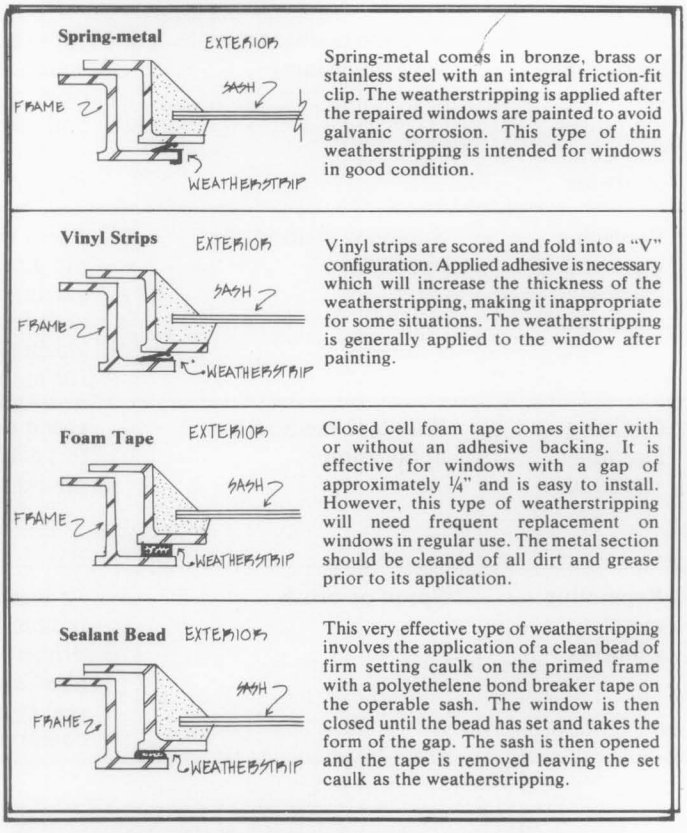

Fig. 8 APPROPRIATE TYPES OF WEATHERSTRIPPING FOR METAL WINDOWS. Weatherstripping is an important part of upgrading the thermal efficiency of historic steel windows. The chart above shows the jamb section of the window with the weatherstripping in place. Drawings: Sharon C. Park, AIA.

[3]One measure of energy efficiency is the U-value (the number of BTUs per hour transferred through a square foot of material). The lower the U-value, the better the performance. According to *ASHRAE HANDBOOK-1977 Fundamentals,* the U-value of historic rolled steel sash with single glazing is 1.3. Adding storm windows to the existing units or reglazing with 5/8" insulating glass produces a U-value of .69. These methods of weatherizing historic steel windows compare favorably with rolled steel replacement alternatives: with factory installed 1" insulating glass (.67 U-value); with added thermal-break construction and factory finish coatings (.62 U-value).

Thermal Glazing

The third weatherization treatment is to install an additional layer of glazing to improve the thermal efficiency of the existing window. The decision to pursue this treatment should proceed from careful analysis. Each of the most common techniques for adding a layer of glazing will effect approximately the same energy savings (approximately double the original insulating value of the windows); therefore, cost and aesthetic considerations usually determine the choice of method. Methods of adding a layer of glazing to improve thermal efficiency include adding a new layer of transparent material to the window; adding a separate storm window; and replacing the single layer of glass in the window with thermal glass.

The least expensive of these options is to install a clear material (usually rigid sheets of acrylic or glass) over the original window. The choice between acrylic and glass is generally based on cost, ability of the window to support the material, and long-term maintenance outlook. If the material is placed over the entire window and secured to the frame, the sash will be inoperable. If the continued use of the window is important (for ventilation or for fire exits), separate panels should be affixed to the sash without obstructing operability (see fig. 9). Glass or acrylic panels set in frames can be attached using magnetized gaskets, interlocking material strips, screws or adhesives. Acrylic panels can be screwed directly to the metal windows, but the holes in the acrylic panels should allow for the expansion and contraction of this material. A compressible gasket between the prime sash and the storm panel can be very effective in establishing a thermal cavity between glazing layers. To avoid condensation, 1/8" cuts in a top corner and diagonally opposite bottom corner of the gasket will provide a vapor bleed, through which moisture can evaporate. (Such cuts, however, reduce thermal performance slightly.) If condensation does occur, however, the panels should be easily removable in order to wipe away moisture before it causes corrosion.

The second method of adding a layer of glazing is to have independent storm windows fabricated. (Pivot and austral windows, however, which project on either side of the window frame when open, cannot easily be fitted with storm windows and remain operational.) The storm window should be compatible with the original sash configuration. For example, in paired casement windows, either specially fabricated storm casement windows or sliding units in which the vertical meeting rail of the slider reflects the configuration of the original window should be installed. The decision to place storm windows on the inside or outside of the window depends on whether the historic window opens in or out, and on the visual impact the addition of storm windows will have on the building. Exterior storm windows, however, can serve another purpose besides saving energy: they add a layer of protection against air pollutants and vandals, although they will partially obscure the prime window. For highly ornamental windows this protection can determine the choice of exterior rather then interior storm windows.

The third method of installing an added layer of glazing is to replace the original single glazing with thermal glass. Except in rare instances in which the original glass is of special interest (as with stained or figured glass), the glass can be replaced if the hinges can tolerate the weight of the additional glass. The rolled metal sections for steel windows are generally from 1" - 1 1/2" thick. Sash of this thickness can normally tolerate thermal glass, which ranges from 3/8" - 5/8". (Metal glazing beads, readily available, are used to reinforce the muntins, which hold the glass.) This treatment leaves the window fully operational while preserving the historic appearance. It is, however, the most expensive of the treatments discussed here. (See fig. 6f).

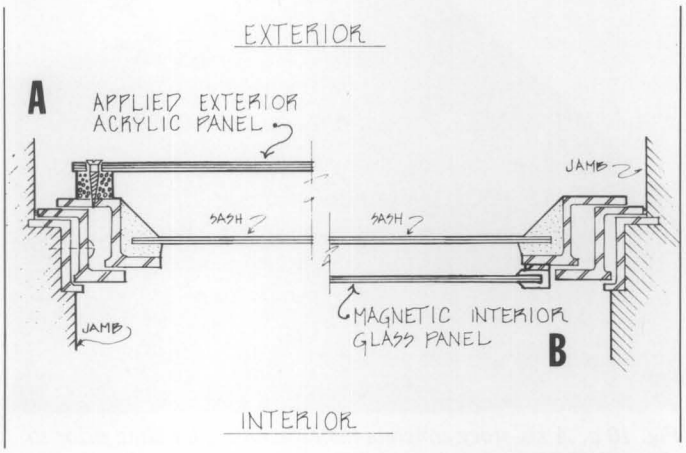

Fig. 9 Two examples of adding a second layer of glazing in order to improve the thermal performance of historic steel windows. Scheme A (showing jamb detail) is of a ¼" acrylic panel with a closed cell foam gasket attached with self-tapping stainless steel screws directly to the exterior of the outwardly opening sash. Scheme B (showing jamb detail) is of a glass panel in a magnetized frame affixed directly to the interior of the historic steel sash. The choice of using glass or acrylic mounted on the inside or outside will depend on the ability of the window to tolerate additional weight, the location and size of the window, the cost, and the long-term maintenance outlook. Drawing: Sharon C. Park, AIA.

WINDOW REPLACEMENT

Repair of historic windows is always preferred within a rehabilitation project. Replacement should be considered only as a last resort. However, when the extent of deterioration or the unavailability of replacement sections renders repair impossible, replacement of the entire window may be justified. In the case of significant windows, replacement in kind is essential in order to maintain the historic character of the building. However, for less significant windows, replacement with compatible new windows may be acceptable. In selecting compatible replacement windows, the material, configuration, color, operability, number and size of panes, profile and proportion of metal sections, and reflective quality of the original glass should be duplicated as closely as possible.

A number of metal window manufacturing companies produce rolled steel windows. While stock modern window designs do not share the multi-pane configuration of

historic windows, most of these manufacturers can reproduce the historic configuration if requested, and the cost is not excessive for large orders (see figs. 10a and 10b). Some manufacturers still carry the standard pre-World War II multi-light windows using the traditional 12" x 18" or 14" x 20" glass sizes in industrial, commercial, security, and residential configurations. In addition, many of the modern steel windows have integral weatherstripping, thermal break construction, durable vinyl coatings, insulating glass, and other desirable features.

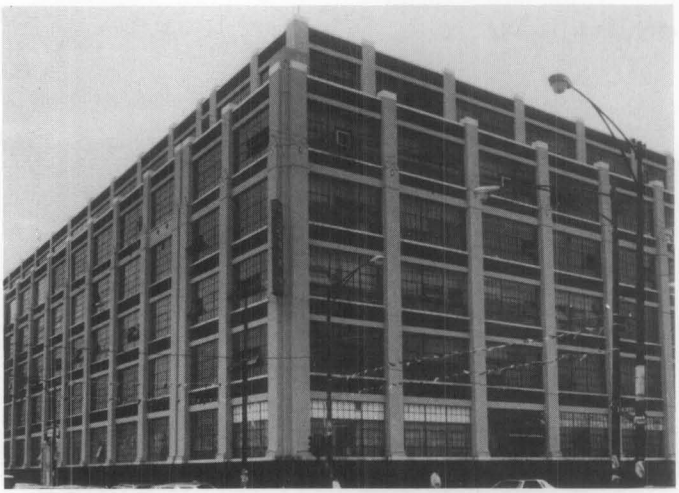

Fig. 10 a. A six-story concrete manufacturing building prior to the replacement of the steel pivot windows. Photo: Charles Parrott.

Fig. 10 b. Close-up view of the new replacement steel windows which matched the multi-lighted originals exactly. Photo: Charles Parrott.

Windows manufactured from other materials generally cannot match the thin profiles of the rolled steel sections. Aluminum, for example, is three times weaker than steel and must be extruded into a box-like configuration that does not reflect the thin historic profiles of most steel windows. Wooden and vinyl replacement windows generally are not fabricated in the industrial style, nor can they reproduce the thin profiles of the rolled steel sections, and consequently are generally not acceptable replacements.

For product information on replacement windows, the owner, architect, or contractor should consult manufacturers' catalogues, building trade journals, or the Steel Window Institute, 1230 Keith Building, Cleveland, Ohio 44115.

SUMMARY

The National Park Service recommends the retention of significant historic metal windows whenever possible. Such windows, which can be a character-defining feature of a historic building, are too often replaced with inappropriate units that impair rather than complement the overall historic appearance. The repair and thermal upgrading of historic steel windows is more practicable than most people realize. Repaired and properly maintained metal windows have greatly extended service lives. They can be made energy efficient while maintaining their contribution to the historic character of the building.

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This publication has been prepared pursuant to the Economic Recovery Tax Act of 1981, which directs the Secretary of the Interior to certify rehabilitations of historic buildings that are consistent with their historic character; the guidance provided in this brief will assist property owners in complying with the requirements of this law.

Preservation Briefs: 13 has been developed under the technical editorship of Lee H. Nelson, AIA, Chief, Preservation Assistance Division, National Park Service, U.S. Department of the Interior, Washington, D.C. 20240. Comments on the usefulness of this information are welcomed and can be sent to Mr. Nelson at the above address.

May 31, 2013

Ms. Alice Novak, Chair
Historic Preservation Commission
City of Urbana
400 South Vine Street
Urbana, IL 61801

Re: Landmark Nomination for 1404 South Lincoln Avenue, Urbana

Dear Ms. Novak:

I am writing you to express my support for the Landmark Designation for the Zeta Tau Alpha house at 1404 South Lincoln Avenue in Urbana. I am an architectural engineer working on historic building restoration projects in Chicago. I am also a graduate of the School of Architecture at the University of Illinois and a former resident of Urbana while in graduate school.

I have maintained ties to the area as the current treasurer of the Anthemios Control Corporation, which is the managing organization for the Alpha Rho Chi professional architecture fraternity at 1108 South First Street in Champaign. The APX house was also designed by Joseph Royer and shares a striking similarity to the Zeta Tau Alpha house.

I have watched with great sadness as so many of the historic fraternities and sororities have been demolished over the last few years. The University of Illinois campus has one of the largest collections of historic greek letter societies anywhere in the world – a resource that should be treasured. The quality of the architecture and attention to detail of these buildings are unmatched in new construction.

The Zeta Tau Alpha house is significant for its architecture, the prominence of the architect as well as for its inclusion in this grouping of greek letter society houses, which has played such an important role in student life on the university campus. The house features an exterior, nearly unaltered over time with original doors, windows, decorative brick, and clay tile roof. Like the National Register of Historic Places-listed Alpha Gamma Delta house at 1106 South Lincoln Avenue, the Zeta Tau Alpha house has an addition fronting Lincoln Avenue, but the architecture of the addition closely matches the original building and the age of the addition makes it significant in its own right.

These historic fraternities and sororities are a significant part of the architectural fabric of the West Urbana neighborhood. The greek houses are interspersed with large and small single family homes and apartment structures.

Because of the quality of the architecture and historical importance, I encourage you to landmark the Zeta Tau Alpha house so that it can be protected for future generations. I also encourage the owners of the building to find a reuse for the building so that it does not sit empty and decay. Thank you for your consideration.

Sincerely,

Christopher Enck
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Chicago, Illinois
cjenck@gmail.com