Figure 4

Throughout the remainder of the summer and fall we continued to hold Sabbath services at Tupper Lake. Not once did the gathering lack a minyan! We also held High Holy Day services at Rosh Hashana and Yom Kippur, and the first wedding since 1919 occurred in October. We closed Beth Joseph for the winter, but in the spring of 1991 we held a funeral and the synagogue was again opened to a local community of summer residents in July. We continue to hold weekly Sabbath services. Most of the restoration work is complete, except for some finishing touches, and the schul is now open four hours a day, every day. The basement houses a permanent art gallery and four shows are programmed for this summer. In addition we have four concerts and two lectures scheduled over the course of the summer.

Tragically, Sharon Berzok, who had spearheaded the restoration of Beth Joseph, was killed in an car accident in California in 1988. She did not live to see her vision fulfilled. Her ashes are interred in the nearby Beth Joseph cemetery and a plaque has been placed in the synagogue vestibule commemorating her efforts.

For the Friends of Beth Joseph, the heirs of the women who sat in the balcony watching their men at worship, the simple gray building at the corner of Mill and Lake Streets is an ark of our heritage, and an ark of our hope in the future. It stands not only for the past—the hopes and fears of the Russian peddlers and merchants who built it so many years ago. It is also a sign of renaissance, of the rebirth, of the Jewish community in the Adirondacks. Perhaps the restoration of Beth Joseph has been "a profound obligation—an inescapable burden." However, you would never know from speaking with the women who have worked so hard to bring this dream to fulfillment. Whatever the "burden" of this mitzvoth, it has been completely overshadowed by the joyous hearts of those who have worked so hard to see this dream fulfilled.

■

# Is Stained Glass Protective Glazing Necessary?

Many churches, synagogues, public buildings, and private homes have had their stained glass windows covered with various types of protective glazing. Many building owners believe the secondary glazing will protect their stained glass windows from vandalism and the effects of air pollution, and also help conserve energy. Protective glazing does have its uses. However, protective glazing is not an alternative to good maintenance and restoration. It will not correct existing deterioration and will not stop the deterioration process. Properly installed protective glazing may lengthen the life of a stained glass window, although this will not be true for all windows. Improperly installed protective glazing, however, will significantly shorten the life of a window and perhaps lead to irreparable damage.

To determine whether protective glazing is needed and, if so, which system of glazing is best, a number of considerations must be addressed. The most important are the structure, age, and condition of the windows. The windows' materials and the methods used in their fabrication are important to consider as well. Are they painted? Is the came (the metal strips holding the panes of glass together) made from lead, zinc, or copper? What materials make up the existing framing? It is advisable to get an expert opinion on the condition of the windows from an independent consultant. This should be done *before* contracting with a stained glass studio.

It must also be determined which sort of deterioration the windows are subject to. In areas of high vandalism, all stained glass windows should be protected from the potential for deliberate damage or theft. If the windows have extensive painting on the exterior or are made with an unusual or particularly fragile glass, it is also advisable to protect them. Fired vitreous paint is often unstable in many 19th and early 20th century stained glass windows—a condition that may be exacerbated both by pollution and humidity. On the other hand, if the windows are unpainted, protective glazing will not protect anything except the came, which actually *benefits* from exposure to air pollution.

### Air Pollution

Protective glazing is often installed to protect a window from air pollution. The element in air pollution commonly thought to be dangerous to stained glass is sulfur dioxide, which dissolves in water or water vapor to become sulfuric acid. American stained glass is virtually impervious to most forms of atmospheric pollution, including attack by sulfur dioxide in air pollution. However, painting on the exterior of the window may be susceptible to the effects of pollution and weathering. In this case some form of protective glazing may be warranted.

The strips of lead (cames) holding the stained glass together are also impervious to most forms of air pollution. When lead reacts with the sulfur dioxide in the air, it forms a dull gray protective layer of lead sulfate on its surface. This layer of corrosion actually makes the lead came resistant to damage and deterioration.

### Energy Conservation

One of the more common reasons cited for protective glazing is the need for energy conservation.

The putty with which a stained glass window is sealed is usually made with an organic oil medium such as linseed or soya oil. It has a life span of 25 to 75 years, depending on the installation. As the oil dries and shrinks, the putty hardens and cracks, losing its adhesion to the glass and the lead. It may eventually crumble and fall out. This causes the window to leak both water and air, which will result in heat loss. Deteriorated putty also contributes to the sagging that is commonly seen in stained glass windows. Protective glazing is often installed to correct this problem. However, it is far more advisable to reputty and relead the windows as needed. Installing protective glazing will not solve the basic problem—the deterioration of the window.

Churches and synagogues with large interior spaces and many windows often install protective glazing to lessen the amount of heat cumulatively lost through drafty windows. Before a building committee considers protective glazing, however, it would be well-advised to have an energy audit taken of the building, which will pinpoint the locations of greatest heat loss. It may well be that more heat is lost through an uninsulated attic than through the stained glass windows.

### Breakage

Perhaps the most compelling argument for installing protective glazing is to combat breakage. Glass is fragile and can be easily broken. Most breakage occurs from the impact of some object. The causes can be either accidental, as with hail stones or a stray baseball; or intentional, as in an act of vandalism. Much of this type of breakage can be avoided with the right type of protective glazing. (Note: Breakage can also occur from structural movement in the stained glass panel or in the building itself. Protective glazing, of course, will not prevent this type of breakage.)

## EFFECT OF PROTECTIVE GLAZING

When considering the installation of protective glazing, it is vitally important to know how the secondary glazing will affect the stained glass window. While protective glazing may solve some existing problems, it may create new ones. These problems could be serious, and whatever short-term advantages are gained from the installation of the glazing may be outweighed by the long-term negative effects.

### Water

Water is the worst enemy of stained glass windows. Standing water, such as condensed water vapor, will etch and pit glass, remove fired paint, promote the corrosion of metals, rot wooden window frames, and leach mortar from masonry faster than any other natural cause. A dangerously wet situation is rarely found in an unprotected window, but

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Figure 1: In this installation no air space was left between the stained glass and the exterior protective glass, and no ventilation was provided. As a result, condensation collected on the lead cames for many years, resulting in their complete decomposition.

is *frequently* found in windows with inadequately vented protective glazing. If the protective glazing is not adequately vented, it will trap moisture against the window.

Normal atmospheric humidity and rain are not detrimental to most stained glass windows in ordinary, unprotected installations. In fact rain washes hygroscopic (water-attracting) dirt off the window. Circulation of air allows moisture from rain and condensation to evaporate, keeping the window dry. However, protective glazing prevents the exterior of the window from being washed, so hygroscopic dirt particles remain on the glass and trap any water vapor that does not evaporate from the cavity between the stained and protective glass. This results in moist dirt that will dissolve the glass and paint, and corrode the lead came (Figure 1).

The metal components of a stained glass window (lead or zinc came, copper tie wires, copper foil, iron or steel support bars) are all also subject to varying amounts of corrosion from moisture. Metals, of course, conduct heat and cold with remarkable efficiency, which encourages condensation to form on their surfaces. If humidity and condensation are not counter-acted by air circulation, they can be very harmful to the metals as well as to the paint and glass. When the metals deteriorate enough, they will cease to support the glass, the window will bulge and sag, and eventually, if the problem is not addressed, the glass will fall out.

Organic acids will also corrode the lead came relatively rapidly, turning it into a white powder. These acids are produced when wood in window frames becomes wet and begins to deteriorate, or by the curing of certain compounds in varnishes and some silicone caulks occasionally used in stained glass. In the closed environment of a protected window, these acids may remain in contact with the window, rather than being allowed to disperse into the air as they would in an unprotected window.

In order to prevent these problems protective glazing must have adequate ventilation at the top and bottom of each independent panel to allow a full exchange of air several times a day (Figure 2).

The natural deterioration process of a stained glass window will not be eliminated by the installation of a protective glazing system. Glass, lead, support bars, and putty will age and break down whether they are protected or not.

Much of the deterioration of lead cames is physical, caused by expansion and stretching, which results in cracking and fatigue. Protective glazing will neither improve or prevent this type of deterioration. It may, in fact, accelerate it by allowing a build-up of heat between the stained glass and the protective glazing, causing the came to stretch further because of the downward weight of the glass.

## DESIGN OF PROTECTIVE GLAZING

If protective glazing is determined to be necessary, its design and installation must be carefully considered and executed. The system must:

1. serve its function of protection without causing harm to the stained glass;
2. be easily removable for future cleaning or restoration of the stained glass or frames;
3. be aesthetically sensitive to the building;
4. be installed with proper ventilation;
5. meet all pertinent building codes and other regulations, including historic district standards; and
6. be relatively maintenance-free.

The type of glazing to be installed should meet all the provisions listed above. Glazing materials may be glass or plastic and can be plain sheets or be leaded to match the design of the window.

Generally speaking, glass looks better than plastic. Clear glass does not scratch or yellow and will not affect the color or amount of light that enters through the stained glass. Glass is fragile, however, and will provide little protection against vandalism, unless unbreakable glass is used (i.e., tempered or laminated glass). In addition, since glass is heavy, any glass protective system will increase the stress placed on the window frame, which must be strong and sound enough to support it.

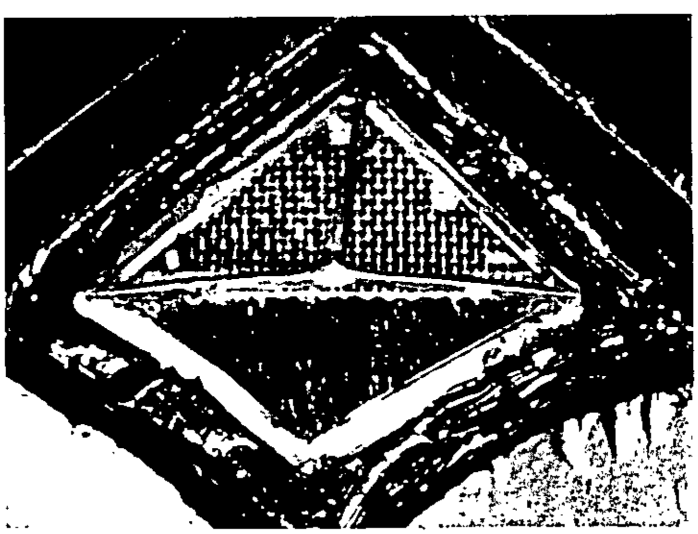
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Figure 2: A detail of a vent in the peak of a window. The upper part of the opening is left open and screened to keep out insects.

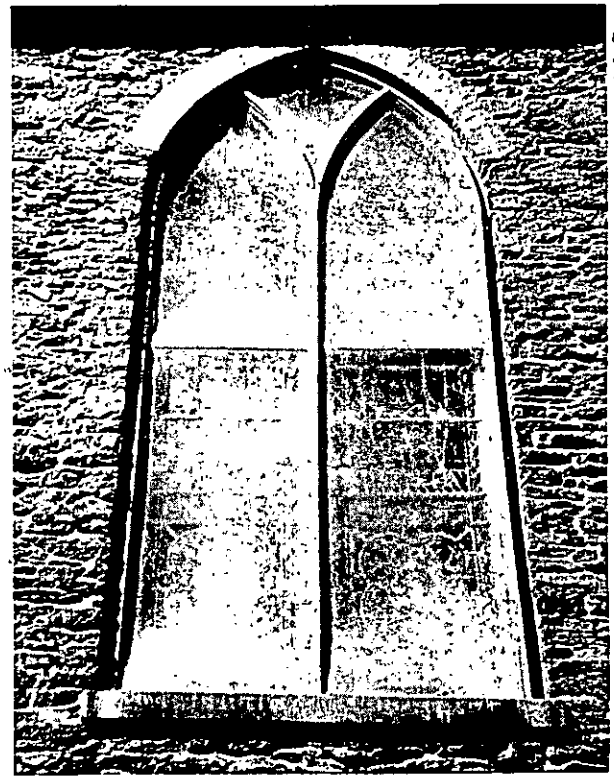
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Figure 3: A typical example of polycarbonate protective glazing that has been in place ten years. The plastic has yellowed and become opaque as a result of the natural weathering process.

There are two basic types of rigid plastic material used for protective glazing: acrylic and polycarbonate. Acrylics, which are best known by the trade names Plexiglas (R), Lucite (R), and Persex (R), are initially less resistant to breakage, yellowing and scratching than are polycarbonates For the first several years of its life, polycarbonate sheet, best known by its trade name Lexan (R), is stronger than acrylic. However, this initial high impact strength declines rapidly on exposure to the elements; after about five years, acrylic and polycarbonate have similar impact strength. Both materials are available with an ultraviolet filter to decrease yellowing, but they still tend to scratch and become opaque. Neither material has an expected life span of more than ten to twenty years. In most installations, both materials age quite poorly, yellowing and becoming opaque due to scratches caused by wind abrasion (Figure 3). An additional disadvantage is their high rate of expansion, which leads to bowing if the frames have not been designed to accommodate this expansion.

Glass or plastic can be installed in full sheets. All plastics and any kind of plate glass (including tempered and laminated) are installed this way. This type of installation is usually faster and less costly than a leaded pattern. However, the major drawback is the appearance (Figure 4).

Figure 4: This is an example of insensitively installed protective glazing. The stained glass is completely invisible and the arrangement of the aluminum muntins bears no relation to the window behind, resulting in distracting shadows on the stained glass.

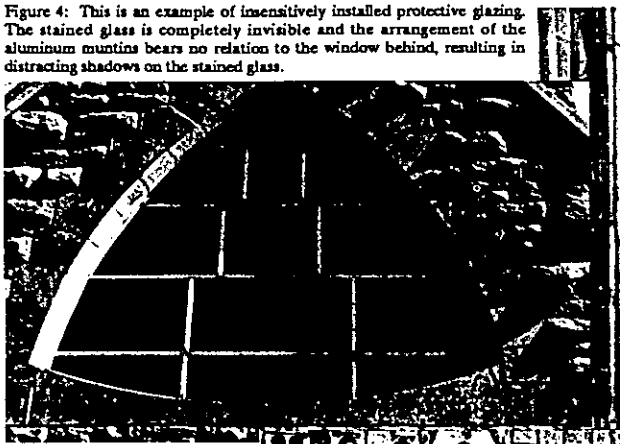

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Figure 6: An example of fully leaded protective glazing. The protective glazing is almost indistinguishable from the stained glass behind it.

Most stained glass windows do not reflect the surrounding environment. Plate glass and plastic, on the other hand, are highly reflective and substantially change the exterior appearance of the windows.

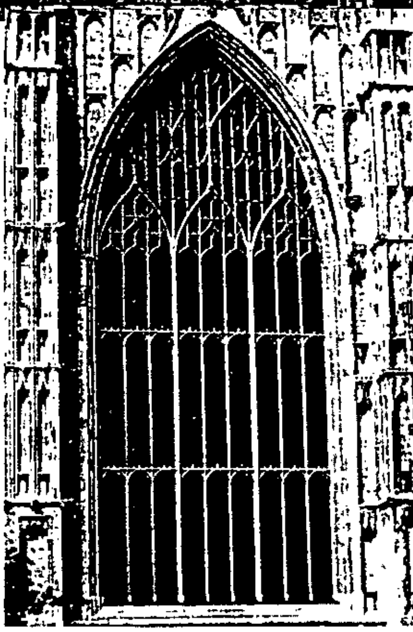

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Figure 5: An example of glass protective glazing arranged in diamond-shaped quarries.

If the decision has been made to use glass, the owner has the option to choose a leaded pattern instead of a full sheet (unless tempered or laminated glass is required). A leaded protective panel may be more desirable than a full sheet in buildings where exterior appearance is of primary importance. Leaded glass is usually more compatible with the historic character of older religious buildings and will not result in a highly reflective surface, as with large sheets of glass or plastic. There are two basic approaches to leaded designs for protective glazing: geometric patterns (quarries) or fully patterned.

A protective glazing panel may be assembled of regular, repeating geometric shapes such as diamonds, rectangles or other polygons (all are called quarries). These are made from any type of clear window glass that can be cut and fit into a lead came. The disadvantages to this type of protective glazing are its expense and the shadows cast by the cames on the stained glass inside. The advantage is that the appearance of the leaded window is maintained on the exterior (Figure 5).

The ultimate design for protective glazing is the recreation of the design of the stained glass window in the protective glazing panel. Whether this includes every lead line from the stained glass or only the essential lines of the design, the effect is almost identical to the unprotected window, except that it is made of clear glass. The chief drawback is its high cost. Its major advantage is that the appearance of the original leaded window is maintained (Figure 6).

The installation of the completed protective panels into frames is as important as the designs of the panels. The frames of the existing stained glass must be examined for soundness, and their design and structure analyzed to determine if additional frames are needed for the protective glazing.

*The protective glazing must be installed at least one inch away from the stained glass, in most cases, and the cavity must be ventilated.* These requirements are necessary to insure the circulation and complete exchange of air around the stained glass.

*All other compromises in the design and installation of protective glazing are acceptable as long as the protective glazing is properly vented.* There is always controversy over whether this venting is better done to the exterior or the interior. As in all aspects of conservation, the answer depends upon the specific qualities if the individual site. Consequently, the design of the protective glazing should be overseen by a consultant.

When considering protective glazing, it is important to be aware that it is not an alternative to good maintenance and restoration. It will not correct existing deterioration, nor stop the deterioration process. It is not a conservation measure when used alone or improperly. Properly installed, protective glazing may, in some cases, lengthen the life of a stained glass window, but this will not be true for all windows. Improperly installed, protective glazing can cause more harm in a shorter period of time than if the window were not protected at all. ■