PRESERVATION

Tech Notes

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HISTORIC GLASS
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Repair and Reproduction of Prismatic Glass Transoms

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HAMM BUILDING
ST. PAUL, MINNESOTA

Introduced in the 1890s, prismatic glass transoms were a popular and practical means of directing daylight into building interiors. With origins in sidewalk vault lights and glass panels used on ship decks, prismatic tiles had ridges or other raised patterns on their inside surface that refracted sunlight toward the rear of a building. The pressed tiles were usually joined together with zinc or lead in a process similar to that used to create stained glass windows *(see figure 1).* An alternate, less common approach was to bond the tiles to copper strips during immersion in an electrolytic bath, a process known as electroglazing. At the peak of popularity, over a dozen manufacturers offered varying tile patterns—each "scientifically designed" to increase natural light levels and thereby reduce reliance upon light wells and artificial light sources. Prismatic glass tiles were used both in new construction and to update existing storefronts, until changing tastes and the dominance of electricity led to their functional obsolescence by the 1930s.

Although prismatic transoms were seen most frequently above the display windows and doorways of modest main street buildings, they were also used in larger commercial structures. An example is the Hamm Building in St. Paul, Minnesota. This six-story structure, with shops on the ground floor, offices above, and a theatre on one side, was completed in 1920. The exterior of the building was especially admired for its cream-colored terra cotta with Classical and Renaissance Revival ornamentation.

Another important feature of the Hamm Building exterior was the large band of prismatic glass located just above the storefront awnings (*see figure* 2). Divided into groups of three and four panels separated by terra cotta pilasters,

Deteriorated prismatic glass transoms should be repaired using historic tiles. When tiles are missing, the transoms should be replicated using glass that matches closely the appearance of the historic prisms.

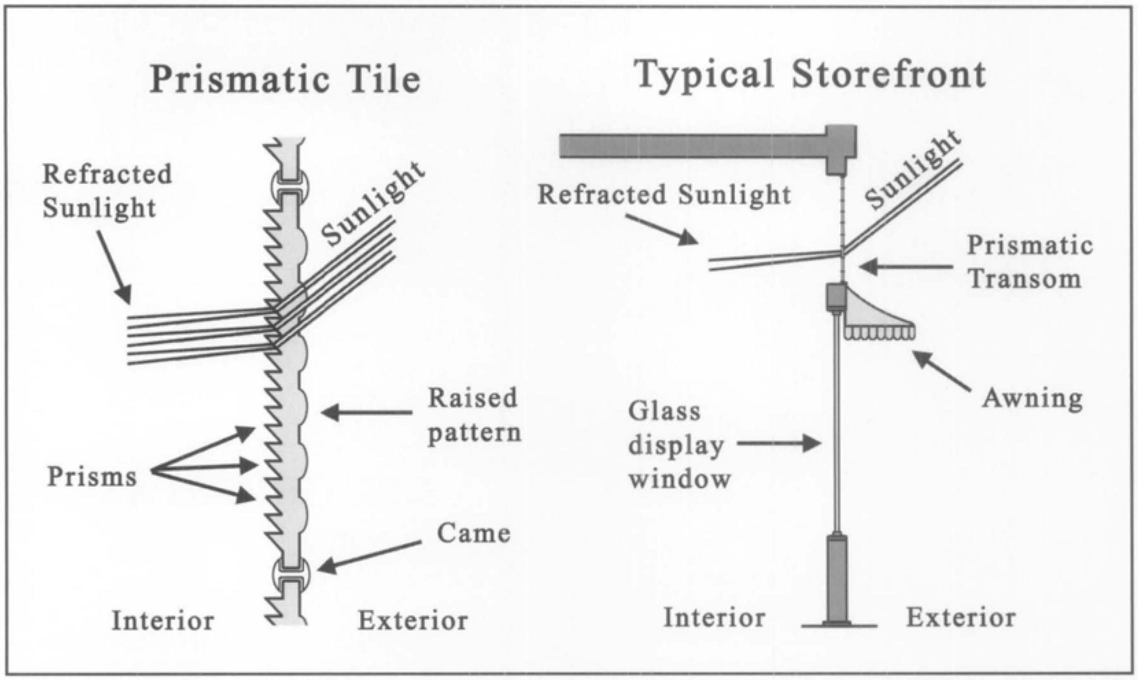

Figure 1. A typical prismatic tile glazed with zinc came is shown on the left. Tiles on the Hamm Building had a pattern of raised circles on the inside surface. The drawing on the right illustrates a typical storefront with prismatic transom. Drawing: Chad Randl

their placement mirrored the fenestration pattern of the rest of the facade. Each of the fifty-six panels was approximately 4 1/2´ tall by 5´ wide and contained 224 tiles, each measuring 4˝ high by 4˝ wide by 1/4˝ thick. The tiles were made by the Manufacturers Glass Company, one of several prismatic glass producers based in Chicago. Two types of tiles were used in each Hamm Building panel. Most featured uniform rows of raised circles resembling bubbles on both sides of the tile. The other tile pattern had bubbles on the interior face only, with the manufacturer's trademark logo on the exterior side. (Both differed from a more common prism tile of the time that featured horizontal ribs on the inside surface). In the Hamm Building transoms, the trademark tiles were arranged in a square border along the edge of each panel (*see figure 3*). The prisms were glazed with zinc came and set within a copper frame. A small pivoting ventilator was located in the center of each panel.

Like many historic transoms today, a large number of the Hamm Building panels were covered over during a mid-twentieth century renovation. Only partially intact when the building was rehabilitated in the 1990s, the prisms were uncovered, removed, cleaned and reglazed. New glass that approximated the historic prisms was used to replicate several missing panels. With modifications that improved their structural strength, the transoms continue to contribute to the visual interest of the exterior and natural light levels in the interior.

Problem

When the Hamm Building was rehabilitated beginning in 1996, plans were made to return the prism glass transoms to their historic appearance. At the time, all but sixteen of the panels were obscured behind plywood sheets (*see figure 4*). Installed decades before, the covering was probably a response to the gradual deformation of the assemblies and water infiltration that resulted from deferred maintenance. The desire for a more contemporary appearance and more prominent sign space may also have been factors.

After removing the plywood, the individual panels were found to be in various states of disrepair. In approximately 20 percent, the tiles were either completely missing or had fallen to a pile at the bottom of the frame. Most panels that survived were bulging or sagging and had severely pitted and corroded came and cracked solder joints.

Figure 2. The Hamm Building featured fifty-six prismatic panels set directly above the awnings. Each panel contained over two hundred individual tiles. Photo shows completed project. Photo: Chad Randl

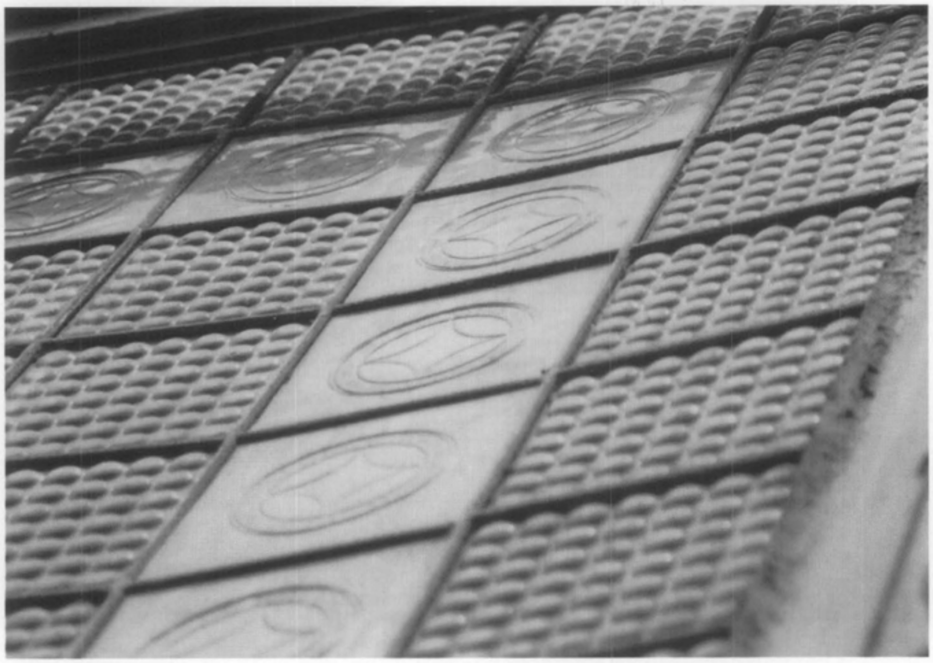

Figure 3. Two tile designs were used in the Hamm Building transoms. Most featured rows of raised bubbles. A second type, with the manufacturer's trademark pattern, formed a border near the edge of each panel. Photo: Oertel Architects.

Numerous paint layers covered the exterior surface of the panels and several had holes cut to accommodate the addition of air conditioning or ventilation ducts (*see figure 5).*

Repairing the transoms required a knowledgeable craftsperson experienced in specialty glass assemblies and exterior installations. A source for replacement tiles was also necessary. Both presented challenges, as the skills and materials developed for the prism glass industry became scarce when the popularity of the panels faded. As is the case with many twentieth century materials from plastic laminate walls to Vitrolite storefronts, finding suitable replacement material was a primary obstacle to restoring the transoms successfully (see sidebar). Prismatic tiles had not been mass-produced for sixty years and all of the manufacturers had either folded or were involved in completely different markets. Finding the right craftsperson or workshop also proved difficult. The work required an understanding both of zinc glazing and the structural and environmental demands that accompanied an installation the size of the Hamm Building panels.

Solution

Repair of the prismatic glass transoms involved removing, disassembling, cleaning, and reglazing the surviving panels with original glass tiles, some replacement glass, and new zinc came. Rehabilitation of the transoms also provided an opportunity to increase the strength of the original assembly. Simply rebuilding the panels according to the original design would establish the same conditions that contributed to their initial failure. With this in mind, the rebuilt panels incorporated unobtrusive changes that provided additional reinforcement.

All of the surviving prismatic tiles were used again in the rebuilt panels. The number of surviving tiles, however, was sufficient to rebuild only forty-six of the fifty-six panels. Since the project team was unable at the time to locate an affordable source for newly cast replacement tiles, a textured, or patterned, glass served as a substitute in the remaining ten panels. Purchased in sheets from an art glass dealer and cut to size in the workshop, the appearance of the replacement glass was a close approximation of the original bubble design.

The contract for rebuilding the Hamm Building transoms was awarded to a local stained glass studio. Their previous work with leaded glass windows demonstrated an understanding of structural load issues, expansion and contraction characteristics, and other concerns relating to glass assemblies in exposed locations. The studio owner also had considerable experience repairing and rebuilding smaller prismatic glass installations. After meeting with the studio team and viewing examples of their ear-

Figure 4. When the Hamm Building rehabilitation began, most of the prismatic tiles (above the awnings) were hidden beneath plywood panels. Photo: Oertel Architects.

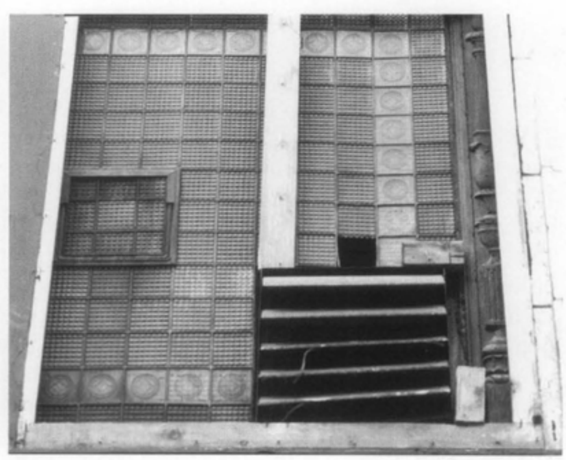

Figure 5. Transoms hidden beneath the plywood covers were in varying condition. Tiles had been removed from the panel above to fit a ventilation duct. When the panels were later rebuilt new material was needed to replace missing tiles. Photo: Oertel Architects.

Replacement Glass for Historic Prism Transoms

Whether a project involves minor repairs or recreating an entire installation that had been removed and destroyed, work on historic transoms often requires replacement material. Zinc came is still commonly in use, and can be supplied by some of the same manufacturers that produced came a century ago. The ingredients of waterproofing grout, likewise, have changed little. Prismatic glass tiles, however, are harder to come by. There are generally three replacement options: custom cast new glass tiles, textured glass and salvaged historic material. Deciding which approach is most appropriate is dependent upon the amount of glass required, the degree of accuracy desired, and the project budget.

Several companies are capable of producing new pressed glass tiles. Some have historic molds bought from defunct prismatic glass companies; others use computer design software and laser cut graphite dies to create patterns that are identical to the historic material. Though this approach results in the most accurate reproduction material, the expense of custom casting may be prohibitive for smaller projects that require few tiles.

Textured, or patterned, glass is sheet glass upon which a pattern is rolled. Several patterns especially those with linear ridges (such as narrow reeded or ribbed glass) may be acceptable substitutions for original prism tiles. Textured glass can be ordered in sheets and cut into tiles in the glazing workshop. Advantages of textured glass over custom pressed tiles include cheaper costs, virtually immediate availability, and a larger number of suppliers.

Reputable specialty glass collectors and salvage companies may be a source for replacement historic prism tiles. The profusion of manufacturers and tile patterns once available limits the likelihood of locating an exact match. Those working with collectors should ensure that original materials on offer were not removed from existing installations purely for salvage and resale.

The color of the replacement glass may also have to be decided. Originally, prismatic tiles were clear. Until World War I, manganese was added to the process to decolorize the otherwise green glass. Decades of exposure to ultraviolet radiation, however, can cause a reaction in the manganese that then imparts a purple or pinkish tone to the glass. It may be possible to find patterned glass or salvaged tiles in a color that approximates that seen in solarized historic tiles. Exact matching is not likely, or necessarily desirable, considering the fact that the replacement material and the historic tiles would continue to change color at different rates. Because the historic tiles on the Hamm Building had not experienced significant solarization, the architects and transom contractor chose a clear patterned glass.

See **http://www2.cr.nps.gov/tps/ptn44/material.htm** for a list of possible replacement material sources.

lier work, the architects decided that the company would provide the level of expertise and quality required for such a historically significant and highly visible project.

Rebuilt Transom Panels

Like most prismatic transoms, the zinc came and the tiles themselves provided the only structural strength to the assembly. Manufacturers figured that zinc was rigid enough to not require additional support. In some cases, such as with the Hamm Building panels, time and weather have proven otherwise. Periodic high winds in downtown St. Paul tended to push the large transoms inward, while unequal atmospheric pressure between the building interior and exterior exerted an outward force. The resulting distortion cracked solders joints and separated came and glass from the waterproofing grout, causing or exacerbating leaks.

To resist these tendencies, the architect and glass contractor attached four vertical bars to the interior face of each panel (*see figure 6*). Flat steel bars 1/2″ deep were spaced three or five tiles apart and soldered on edge at points where the zinc came intersects. Applying continuous solder along the length of the reinforcing bar is not recommended as it may impede future repair efforts. The ends of the bars were then secured to the edge of the frame so that each bar supported sections of less than eight perimeter feet. Because of their thin, 1/8″ profile and placement on the inside of the panel, the braces are invisible from the exterior. A similar approach is often used with leaded glass, where horizontal or vertical saddlebars are tied to the came in order to assume the structural load of the windows.

Repair Work

After the transom contractor established a temporary workshop in one of the Hamm Building's vacant storefronts, each panel was removed and disassembled. Because the shop did not include cleaning facilities, the tiles were inventoried, packed, and sent to a furniture stripping company, where they were immersed in a solvent bath to loosen paint and dirt. The solvent used by the stripping company had been previously tested to ensure that it did not etch, cloud or discolor the glass. In the meantime, the transom contractor built plywood jigs and workbenches in the shop that would facilitate precutting came and assembling the panels. When the cleaned tiles were returned to the site, reglazing began.

The majority of the rebuilt panels incorporated prism glass tiles that were original to the building (*see figure 7*). Both ventilator hardware and the historic trademark prism border were included in the rebuilt panels. The assembly process was similar to that used for stained glass windows. Individual prisms were set in a zinc H-came matrix that was gradually soldered together as more tiles were added. Reinforcement bars were then soldered to the panel. The last major step before reinstallation was to waterproof the assembled panel. A waterproof grout

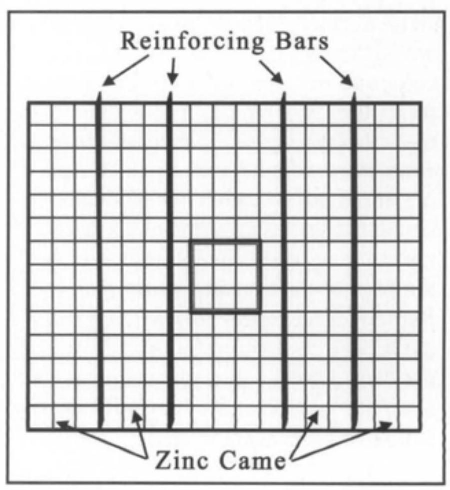

Figure 6. The four vertical reinforcing bars were soldered to the inside face of the transom panel. Drawing: Chad Randl.

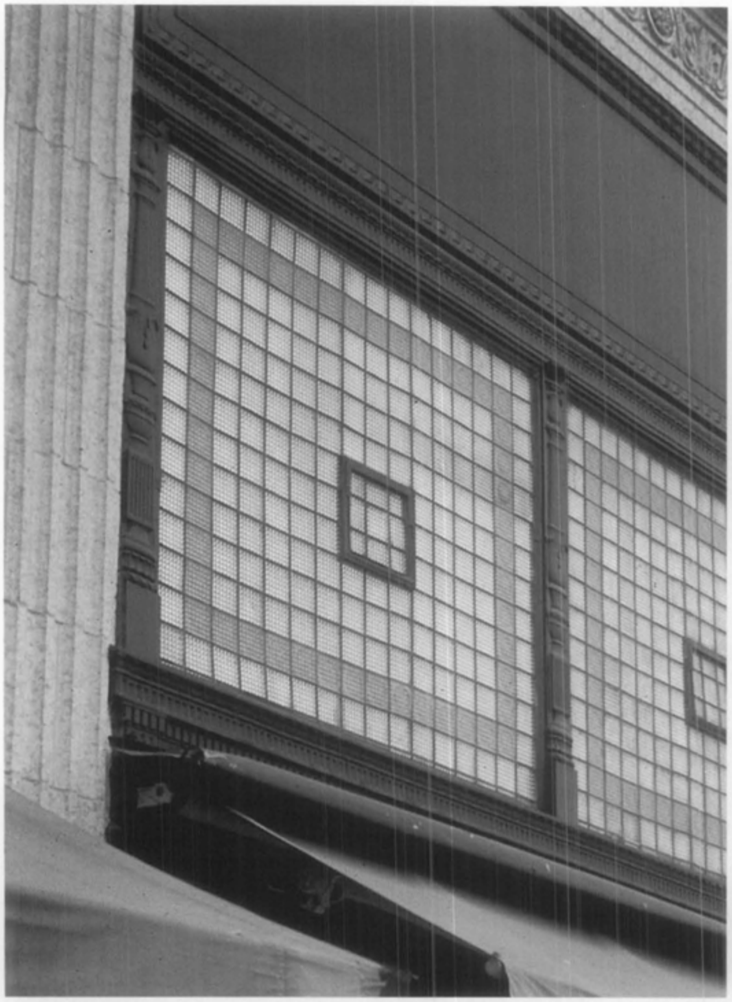

Figure 7. Rebuilt transoms featured prismatic glass tiles and vents that were original to the building. The decorative border of "trademark" tiles was incorporated into the reglazed assembly. Photo: Chad Randl.

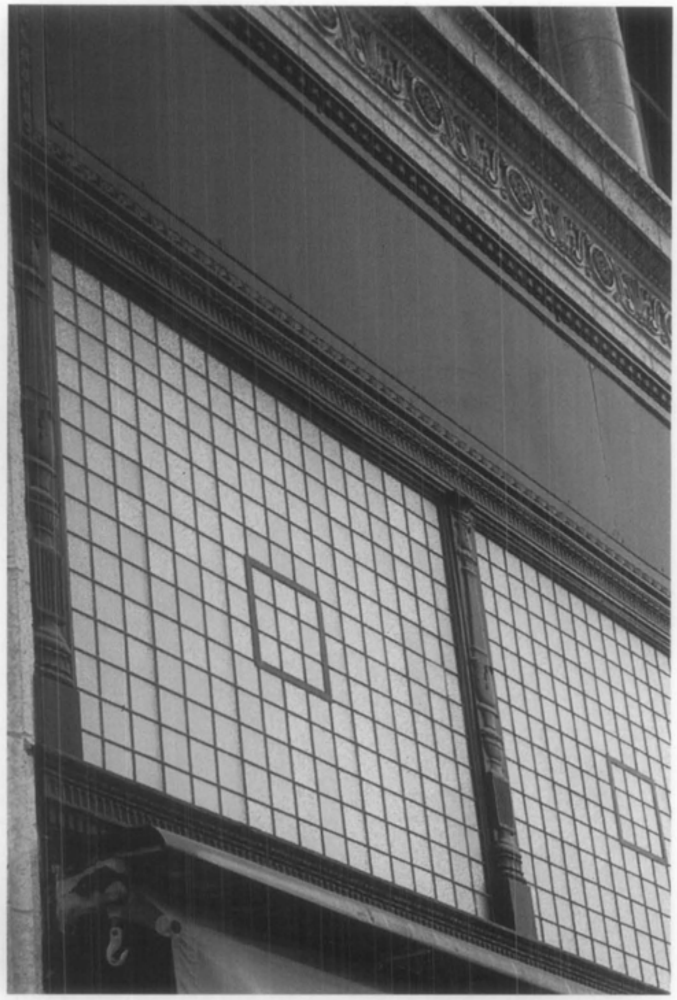

Figure 8. Reproduction panels used a textured replacement glass and replicated vents. The panels were further differentiated from the those with historic glass by the absence of a decorative border. Photo: Chad Randl.

made from a traditional mix of putty, boiled linseed oil and lamp black was forced into the spaces between the came flange and the glass.

The four reproduction panels containing new glass were reglazed in the same manner. A clear, patterned glass called "moss glass" that resembled the color and bubbled texture of the historic prism tiles was used as a substitute material (*see figure 8*). Where historic ventilators were beyond repair or missing, the transom contractor fabricated a simulated vent with strips of capping zinc (a material normally used to cover the edge of the transom frame). Reproduction panels also differed from the historic assemblies in that they did not have a border of trademark tiles along the perimeter. The resulting panels were distinguishable from the historic units up close, but when viewed from the street or the opposite sidewalk, seemed only slightly different from the original panels.

Evaluation

The rehabilitation of the Hamm Building transoms included reassembling over 12,500 prism tiles into fifty-six panels. All of the surviving historic prisms were preserved in the rebuilt transoms. Replacement materials including zinc came and new patterned glass tiles were selected for their similarity to the original materials; modifications were developed that did not significantly alter the historic appearance of the panels.

It was important in this case, for the transom rehabilitation program to address long-term concerns over the structural strength and weather resistance of the original panels. The addition of reinforcing bars counters the tendency of wind and temperature extremes to distort the transoms. Applied on the interior, such a system has the added benefit of being virtually undetectable. The longevity of the panels including their continued weather resistance is best assured through a process of regular inspection and maintenance and, when necessary, regrouting the panels before leaks develop.

Though the Hamm Building transoms were deteriorated to a point where they had to be removed and taken apart, there are occasions where repairs may not require complete disassembly. In cases where the came is in good condition, but a single tile is missing or severely cracked, the panels can be removed to a workshop and the came flange adjacent to the damaged tile opened up with lead pliers. A replacement tile can then be fitted into the channels, and the came pushed back in place by hand and resoldered together. The rigidity of zinc and the difficulty of soldering on a vertical plane make *in situ* repairs to prismatic transoms extremely difficult.

Figure 9. Panels with original tiles are shown on the left next to those featuring replacement textured glass. Photo: Chad Randl.

Conclusion

The Hamm Building prismatic glass transoms are more than a tool for bringing daylight into ground floor shops and entrances; they are an integral feature of the building facade. The preserved prisms impart an openness and visual texture to the storefronts that were important to the building's design and historic appearance. Although the deteriorated condition of the seventy-five year old panels necessitated major repair, the work was planned to retain as much historic material as possible. Reglazed panels incorporated historic tiles and vent hardware while adhering to the dimensions, construction and overall appearance of the historic configuration. Where missing or damaged elements required replacement, new materials approximated the appearance of the original features (*see figure 9*). Lastly, modifications to the transoms improved the strength of the transoms but did not intrude upon the historic appearance of the prismatic tiles and the Hamm Building exterior.

Additional Reading

Neumann, Dietrich. "Prismatic Glass." In *Twentieth Century Building Materials. History and Conservation.* Thomas C. Jester, ed. New York, NY: McGraw-Hill, 1995.

Vogel, Neal A. and Achilles, Rolf. *Preservation Brief 33. The Preservation and Repair of Historic Stained and Leaded Glass.* Washington, DC: US Department of Interior, National Park Service, 1993.

Project Data:

Building:
The Hamm Building
408 St. Peter Street
St. Paul, MN

Owner:
Markham Company of Saint Paul
St. Paul, MN

Project Date:
1996-1999

Architect:
Oertel Architects
1795 Saint Clair Avenue
Saint Paul, MN

Transom Contractor:
Palmer Art Glass
6670 Anoka St.
Fridley, MN

Cost:
The total cost of the transom restoration project including removing fifty-six original panels, cleaning the prismatic tiles, reassembly, fabricating replacement panels, and installation was $80,000. Panels containing original tiles were less expensive than the replacement panels because new glass was not required.

THIS PRESERVATION TECH NOTE was prepared by the National Park Service. Charles E. Fisher, Heritage Preservation Services, National Park Service, serves as the Technical Editor of the PRESERVATION TECH NOTES. Information on the Hamm Building transom project was generously provided by Jeff Oertel of Oertel Architects, Al Palmer of Palmer Art Glass, and John Salisbury of Gaytee Stained Glass. Special thanks are extended to Al Husted of Albert Stained Glass Studio, Neal Vogel of Restoric, Inc., Deborah Slaton of Wiss, Janney, Elstner Associates, and Michael J. Auer, Sharon C. Park and Kay D. Weeks of the National Park Service's Heritage Preservation Services for their review and comments. Thanks also to Judy Randl for assistance in obtaining photographs.

PRESERVATION TECH NOTES are designed to provide practical information on traditional practices and innovative techniques for successfully maintaining and preserving cultural resources. All techniques and practices described herein conform to established National Park Service policies, procedures and standards. This Tech Note was prepared pursuant to the National Historic Preservation Act, which direct the Secretary of the Interior to develop and make available to government agencies and individuals information concerning professional methods and techniques for the preservation of historic properties.

Comments on the usefulness of this information are welcomed and should be addressed to PRESERVATION TECH NOTES, Technical Preservation Services – NC200, National Center for Cultural Resources, National Park Service, 1849 C Street, NW, Washington, DC 20240.

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