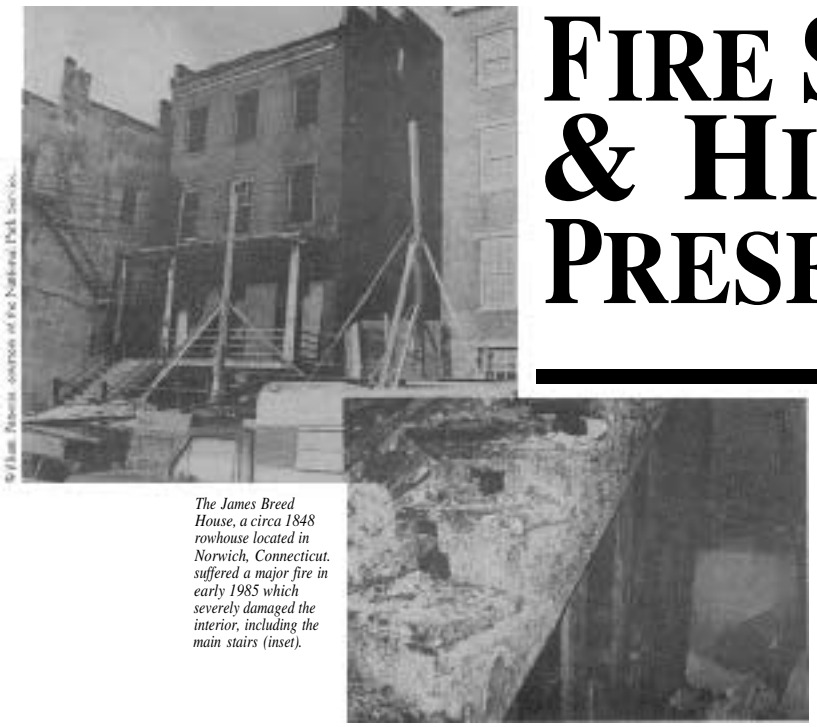
FIRE SAFETY & HISTORIC PRESERVATION

by Charlotte Barrett and John Watts, Jr.

Rehab can be hazardous to a building's health—unless you make fire safety a priority



The James Breed House, a circa 1848 rowhouse located in Norwich, Connecticut. suffered a major fire in early 1985 which severely damaged the interior, including the main stairs (inset).

While fire poses a serious threat to all buildings, historic structures undergoing rehabilitation are particularly vulnerable. The wood is dry with age and easily ignited. Tools used in preservation work often create sparks or flames, and flammable debris is a common by-product. The electrical service may be antiquated and unequipped to handle present-day demands during and after rehabilitation. Protective barriers may be removed for replacement or breached for access to utilities. Rehabilitation may be the most hazardous time in the life of a building.

To safeguard against fire damage, rehab contractors need to avoid starting an accidental fire themselves while working, and they should build fire safety into the project to protect it from future fires.

Safety on the Job

A great many fires in old buildings start when contractors are at work. During paint removal, for example, a blow torch can ignite sheathing or other flammable material. A careless worker may toss a cigarette into a box of debris, or an inexperienced plumber can ignite a floor joist with an acetylene or propane torch.

To prevent fire in the workplace, take the following precautions:

- Prohibit smoking within the building.
- Use a solvent-type stripper, an electric heat gun, or a heat plate, rather than torches or other flame-producing devices, to remove paint from wood. Fires caused by torches can begin with sparks in cracks and hollows in woodwork, and can ignite several hours later when no one is present. Flameless heat guns and heat plates operate at a lower temperature and create less of a fire hazard. But these tools are not without risk either. They can ignite a surface if applied to one area for too long or can ignite combustible dust in the work area. So be careful with them as well.
- Remove wood debris and other combustible rubbish from the site as soon as it is produced.
- Keep portable fire extinguishers available and train personnel in their use.
- Use insulating shields to protect wood and other combustible material from flying sparks and molten metal, especially in welding or cutting operations. These are typically metal frames surrounding fireproof cloth and are available from equipment suppliers. For a thorough discussion of safety precautions, consult NFPA 51B, "Standard for Fire Protection in Use of Cutting and Welding Processes," available from the National Fire Protection Association in Quincy, Mass. (800/344-3555).
- Check for smoldering fires between shifts and at the end of the work day, particularly when heat-producing equipment has been used. Always stop work that involves flame-producing tools at least one hour before the end of the work day to ensure that no fires are smoldering.
- Instruct workers in the location and use of manual alarm systems.
- Provide security against intrusions that could lead to vandalism or arson. If possible, hire someone to walk through the building at intervals during the night to check for intruders and for fires.

Building Fire Safety In

Rehabilitation can actually reduce a building's fire risk if the project planners recognize the existing hazards and design with fire safety in mind. They should consider the following measures at the planning stage:

Ignition sources. All systems that provide power for heating, cooling, and lighting are potential sources of fire ignition. Most often this is the electrical system, where faulty wiring, overloaded circuits, or short circuits in old wiring with defective insulation can ignite a fire. The electrical system should always be evaluated by a licensed electrician. Gas, oil, and solid-fuel heating systems must also be examined for fuel leaks that could lead to fire. There should be sufficient clearance between heating units and surrounding surfaces.

All mechanical and electrical systems should be upgraded to incorporate modern fire-prevention technology. For example, electrical circuits must be properly fused and power demands on older branches should be minimized. Fire detection and suppression systems that automatically alert the local fire department can help control the hazards of furnace rooms, kitchens, or group homes for special-needs populations.

Don't overlook human ignition sources—smoking and arson. Smoking can be controlled to some extent through education. To discourage arson, keep the premises secure and provide good lighting, both inside and outside the building.

Fire safety regulations for construction and finish materials. Fire safety code compliance in a historic building requires a special willingness on the part of the owner, architect, builder, and inspector to explore creative solutions. Under some circumstances, code requirements for slow-burning, heavy timbers or non-combustible construction, such as plaster, are relaxed if they conflict with preservation objectives. In that case, special attention should be given to alternative forms of fire protection, such as automatic fire detection and suppression systems.

Fire safety regulations refer more to the fire endurance of structural framing than to interior finish materials like wainscoting and other decorative woodwork. Yet combustible interiors have contributed to the rapid spread of many fires in both old and new buildings. The smaller the ratio of surface to mass, the more fire resistant the element. Thus old beams and framing are inherently more fire resistant than panelling and two-by-four construction. Drop ceilings, a common panacea for deteriorated plaster ceilings and energy conservation, are a particular fire hazard. Fire in the air space between the original and drop ceilings can travel quickly and unobstructed. Original plaster ceilings should be repaired, rather than covered, whenever possible.

Electrical Systems Checklist

Electrical Panels

☑ Service entrance must be of adequate capacity to handle all electrical appliances on the premises.

☑ A diagram of fuses or breakers should be posted inside or near the panel.

☑ All fuses or circuit breakers should be labeled on the panel diagram.

☑ Fuse capacities should be noted on the panel diagram.

☑ All fuses should be loaded into the proper slots and sockets.

☑ There should be extra fuses with proper capacities stored on the premises.

☑ All empty circuit breaker slots should be covered.

Wiring, Junctions, Switches, and Outlets

☑ All exposed wiring should be protected from possible damage.

☑ Splices and taps should be contained in covered junction boxes.

☑ All wall switches should be covered.

☑ All outlets should be covered.

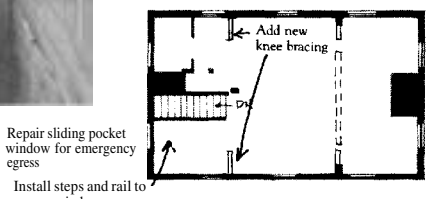
Extension Cords

☑ Extension cords should not be substituted for permanent wiring. All extension cords should be of equal or greater capacity than the appliance cords they serve.

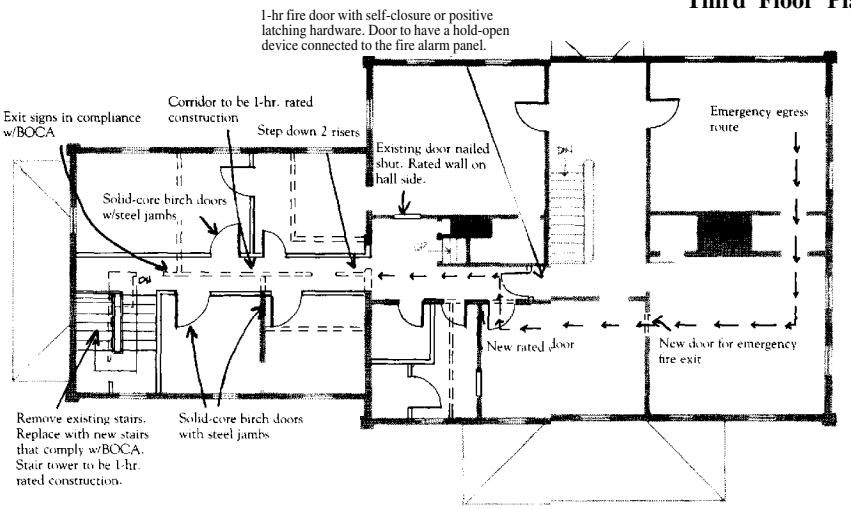
☑ Multi-outlet devices should be rated with the same current capacity as the equipment they service.

Case Study: Saving a Staircase

Front facade of the 1801 Gamaliel Painter house, in Middlebury, Vermont: now a home for 20th-century office space



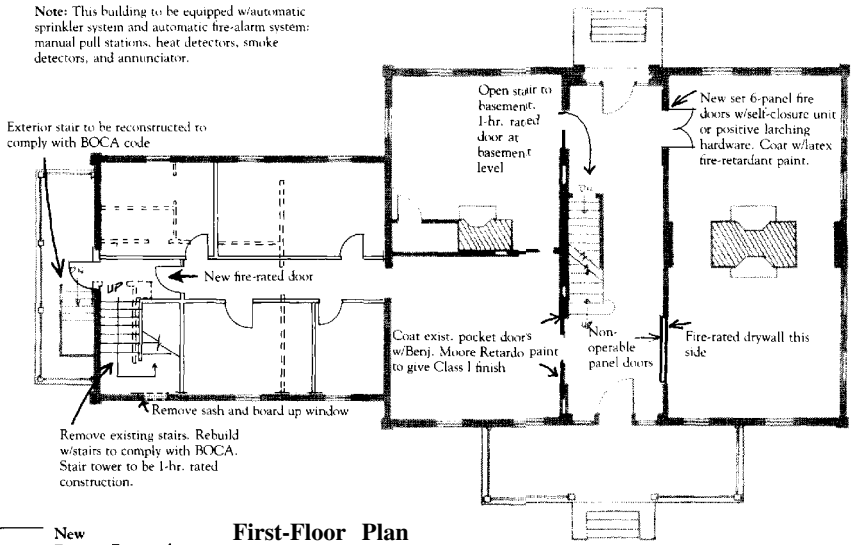
Third Floor Plan



Second Floor Plan
(fire-safety improvements)

Note: All exist. ceilings to have plaster and lath removed. Replace w 5/8 fire-code drywall or resilient channel. Taped and finished w/3 coats joint compound.

Note: This building to be equipped w/automatic sprinkler system and automatic fire-alarm system: manual pull stations, heat detectors, smoke detectors, and annunciator.



New
Existing Removed
Existing Retained

First-Floor Plan
(fire-safety improvements)

Adapted from drawings by Mill Bridge Construction, Inc.

What's wrong with this picture?

Nothing, unless you decide to convert the building to commercial use. Then the grand and historic open staircase becomes a major stumbling block to code approval.

The stair and hall form a central architectural feature in this 19th-century early Federal-period house, and thousands of similar homes throughout New England. For the stair and corridor to qualify as one of the two means of egress required under BOCA, however, either the stairwell, or the entire hall, would need to be fire-rated. This would require enclosing the stairwell in a one-hour rated partition—or finishing the entire hall with rated material. In addition, all openings off the stair hall would need to be enclosed with rated doors operated by spring-loaded hinges or automatic closets.

To comply with these requirements, says Mills Bridge Director of Historic Properties Townsend Anderson, would severely compromise the historic fabric of the house and add considerable cost.

To preserve the stairwell, the design team at Mill Bridge proposed the alternative fire-safety plan shown in simplified form on the floorplans above. The core of the plan is the reconstruction of the south wing to provide an egress route in strict compliance with fire code. The rearranged floor plan, along with the addition of sprinklers, alarms, and other fire-safety measures, was enough to gain approval from the Vermont Department of Labor and Industry for a variance for the central stair area, which received only minor modifications.

Note how occupants on the third floor and in the second-floor office in the northwest comet can now safely exit the building through the new south corridor. Says Anderson, "In this case, we sacrificed the south wing to preserve the main building block. But there are thousands of houses like this in Vermont—with a center hall plan—that create a major conflict between fire safety and responsible historic rehabilitation." ■

—NEB

In situations where the original fabric is beyond repair and must be replaced, the preservationist may want to consider another non-combustible material that is compatible with the historic character of the building. For example, if plaster, which is inherently a good fire retardant when kept in good repair, becomes seriously deteriorated, the preservationist might want to compare the cost of replastering versus Sheetrocking.

Fire-retardant treatments will also reduce the hazard of combustible elements without altering the appearance of historic elements. For example, an intumescent paint can protect wood for several hours by creating an impervious barrier when exposed to fire. The most appropriate treatment depends on several variables, including the surface to be treated, overpainting, and weathering. Thermoplastic coatings, because they melt in fire, are not recommended. If they ignite and burn, before or while falling away from the surface, they may quicken the spread of fire by increasing the exposed surface area.

Means of escape. In a fire, the safety of occupants depends on safe, accessible escape routes. Basically, this means providing enough exits of adequate size with protection from the effects of smoke and heat to permit safe evacuation, even if the principal route is blocked by fire. The exits must be adequately marked, illuminated, and protected from a fire in another part of the building. The exact requirements will depend on how many people occupy the building, the activities conducted within, and how far people must travel to reach an exit in the event of fire.

Regulations requiring that all escape stairways be enclosed with fire resistant-rated walls and fire-resistant, self-closing doors present problems in historic buildings, particularly where the central stairway is an important visual focus of the building (see "Saving a Stairway," p 57). In this case, it may be possible to upgrade original walls by repairing the existing construction or adding new layers of fire-resistant materials. (See the HUD "Guideline on Fire Ratings of Archaic Materials" available from HUD USER, P.O. Box 280, Germantown, MD 20874, 800/245-2691.) Or, sometimes an unenclosed exit is permitted when appropriate fire detection and suppression systems are installed.

Detection and alerting systems. Early detection and alarm is the key to both life safety and the protection of a building and its contents. A large building should have a system to alert both the occupants and the fire department. The smoke alarms should connect to a central station alarm facility or fire department.

At a minimum, install one of two types of smoke detectors. Photo-electric detectors emit a beam of light to a receiver within the detector or elsewhere in the room. When smoke particles block the light path, they trigger the alarm. In ionization detectors, smoke particles interrupt the flow of electrons between two electrodes in the detector and trigger an alarm. Heat detectors, which cannot detect small, smoldering fires, may serve as a backup to smoke alarms or be used in smaller, unoccupied areas. (For further information, see NFPA 72E, "Automatic Fire Detectors," 1987.)

Fire-suppression equipment. Automatic sprinkler systems, which release water directly onto the fire before it grows large enough to cause serious damage, have established a record of cost-effective fire protection for commercial and industrial occupancies. New developments in speed of actuation and distribution of water promise to make their use even more widespread. The installation of sprinklers should be seriously considered in any structure of significant monetary, historic, or architectural value.

While water is less damaging than fire to a building and its contents, some owners of historic properties are reluctant to install a "wet pipe" sprinkler system that is a visual intrusion and that could be inadvertently triggered by physical contact. If this is the case, there are some more expensive alternatives.

In a pre-action, dry-pipe system, the sprinkler piping contains air and fills with water when actuated by a fire detection system. Because this system minimizes the chance of accidental discharge of water due to mechanical damage to sprinkler heads and piping, it is particularly appropriate for protecting historic interiors. There are also special sprinkler heads which are designed to turn themselves off when normal temperature is restored, indicating that the fire is under control. The valve will continue to open and close in response to the temperature sensed by the fire detectors.

In a halon suppression system, halogenated gas is stored in tanks placed in discreet locations and released under extremely high pressure. The halon extinguishes fires by inhibiting the chemical reaction of fuel and oxygen. Although halon gas does not damage valuable interiors, its harmful effect on the ozone layer of the earth's atmosphere makes its appropriateness questionable.

In a carbon dioxide system, larger tanks are required off site and the gas travels through a piping system to be released through nozzles into the room. the pipe in this system is less elaborate and less obvious than an automatic sprinkler system.

Portable fire extinguishers should also be available to people trained in their use. During construction, each worker using heat- or flame-producing tools should have his own extinguisher within reach. Insurance companies often offer programs and written materials on the use of extinguishers. Local fire departments, as well, may provide this service to the community.

At the very least, require all personnel to acquaint themselves with operation of the extinguishers before they are needed. Above all, if a fire is bigger than you are (four to six feet high), call the fire department first, before trying to extinguish it.

Working with the local fire department. Consult the local fire department to identify ways to prevent fire and to plan for fire emergencies during and after completion of the project. Of primary concern is access to the building for firefighting equipment and an available water supply. Keep pathways into the building and the area around fire hydrants clear of equipment, piles of rubbish, and dumpsters, so fire fighters and equipment can move quickly. Remember that rubbish is combustible—empty boxes, newspapers, and woodscraps are a fire waiting to happen. It is always wise to notify the local fire department of any construction work in progress, so that it can be on alert.

Changing the use of historic buildings can increase their fire risk—or it can reduce the risk if the right steps are taken. Addressing this issue at a project's outset will save money, but more importantly, human lives and irreplaceable historic and architectural resources. ■

Charlotte Barrett is director of the Preservation Institute for the Building Crafts, in Windsor, Vt., a nonprofit offering workshops on preservation technology and traditional building skills for building professionals. Dr. John M. Watts, Jr. is director of the Fire Safety Institute, a nonprofit information, research, and educational corporation in Middlebury, Vt. He is chairman of the National Fire Protection Association (NFPA) Technical Committee on Libraries. Museums, and Historic Buildings.

NFPA Standards

The following fire safety standards are published by the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269. They may be ordered by calling 800/344-3555.

Portable Fire Extinguishers NFPA 10, 1988.
Halon 1301 Fire Extinguishing Systems NFPA 12A, 1987.
Installation of Sprinkler Systems, NFPA 13, 1987.
Inspection, Testing, and Maintenance of Sprinkler Systems, NFPA 13A, 1987.
Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes, NFPA 13D, 1984.
lnstallation of Sprinkler Systems in Residential Occupancies Up to Four Stories in Height, NFPA 13R, proposed for 1989.
Cutting and Welding Processes, NFPA 51B, 1984.
Automatic Fire Detectors, NFPA 72E, 1987.
Testing Procedures for Local, Auxiliary, Remote Station, and Proprietary Signaling Systems, NFPA 72H, 1988.
Household Fire Warning Equipment, NFPA 74, 1984.
Life Safety Code, NFPA 101, 1988.
Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances, NFPA 211, 1988.
Safeguarding Building Construction and Demolition Operations, NFPA 241, 1986.
Protection of Historic Structures and Sites, NFPA 913, 1987.
Rehabilitation and Adaptive Reuse of Historic Structures, NFPA 914, proposed for 1989.

For further training: *Interested in fire-safety training for your staff? The Preservation Institute for the Building Crafts (PIBC) will host a three-day conference, Nov. 1-3, 1988, in Ascutney, Vt., on meeting fire-safety codes and historic preservation standards in older buildings. For information, contact Charlotte Barrett, PIBC, P.O. Box 1777, Windsor, VT 05089; 802/674-6752 or 802/674-6729 (after 5 p.m.).*

In addition, PIBC offers in-house training for your staff on the permit process, fire-detection and suppression systems, access and egress standards, and a variety of related topics. Contact Ms. Barrett at the above number for more info.