New York Landmarks Conservancy

Common Bond

Tiffany Stained Glass Windows

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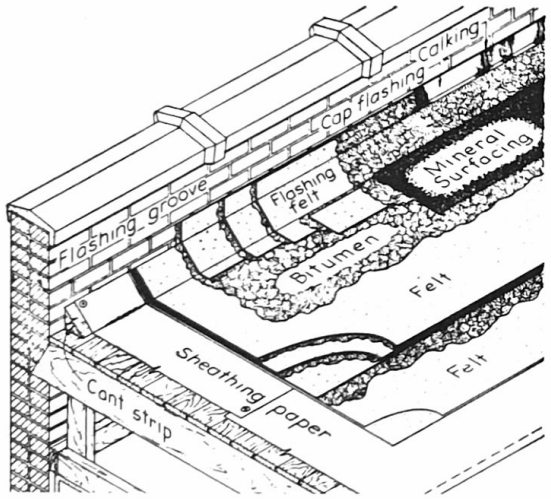
Volume 12, No. 3/December, 1996

Building Components: Flat Roofs

Unseen and often overlooked, flat roofs require routine maintenance and detailed repair to effectively prevent water infiltration.

Many religious institutions have some type of flat (or low-sloped) roof that is only inspected after a leak occurs. And while they are not as glamorous or visible as slate, tile, or copper roofs, flat roofs are just as important and even require more attention. To avoid wasting large sums of money on short-lived repairs (especially those using roofing tar), it is important to understand how flat roof systems are designed, the various types of roofs available, and the importance of routine inspection and maintenance.



George W. Shaw in *Care and Repair of the House*

A multiple-ply or built-up roofing system.

Wesley Haynes

Standing water (also called ponding) is a sign of drainage problems. Leaks will occur if there are any defects in the roof membrane or flashing.

Flat roof systems work by providing a waterproof membrane over a building. They consist of one or more layers of hydrophobic material placed over a structural deck with a vapor barrier typically placed between the deck and roof membrane. Flashing, thin strips of material such as copper, intersect with the membrane and other building components (such as the parapet walls) to prevent water infiltration. Water is directed to drains, downspouts, and gutters by the slight pitch of the roof.

Types of Flat Roofs

The four most common types of flat roof systems, listed in order of increasing durability and cost, are: roll asphalt, single-ply membrane, multiple-ply or built-up, and flat-seamed metal. They range in cost from as low as $2 per square foot for roll asphalt or single-ply roofing applied over an existing roof to $20 per square foot or more for new metal roofs.

Asphalt roll roofing, used since the 1890s, generally consists of one layer of asphalt-saturated organic or fiberglass base felts, applied over roof felt with nails and cold asphalt cement, and usually covered with a granular mineral surface. Seams are typically covered with a roofing compound. Roll asphalt lasts about 10 years. Minor maintenance and temporary repairs such as small patching can sometimes be performed by knowledgeable building staff or volunteers. Permanent repairs and reroofing should be performed by a qualified contractor.

Single-ply membrane roofing is the newest type of roofing material and is often used to replace multiple-ply roofs. Hundreds of proprietary products are on the market, including modified bitumen (bitumen is a class of cementitious substances found in asphalts or tars), rubberized asphalt, elastomeric membranes such as ethylene propylene diene monomer (EPDM), and polyvinyl chloride (PVC) sheets. They may be self-adhered, installed with hot asphalt, or installed by heating the underside of the sheet with a propane torch or other device. Installation and repairs should only be performed by roofers authorized by the manufacturer. Warranties of 10 to 12 years are typical, but as with any roofing system, proper installation is crucial and maintenance by the owner is still required.

Multiple-ply or built-up roofing (BUR) is composed of overlapping rolls of saturated or coated felts or mats, interspersed with layers of bitumen, and generally surfaced with a granular roofing sheet, ballast, or tile pavers to protect the underlying materials from weathering. Built-up roofs are designed to last 10 to 30 years, depending on the materials used. Ballast (also called aggregate) of crushed stone or water-worn gravel is embedded in a coating of asphalt or coal tar. However, since the ballast or tile pavers cover the membrane, inspecting and maintaining the seams of the roof can be difficult.

Flat-seamed metal roofing, used since the 19th century, is made from small pieces of sheet metal soldered flush at the joints. It can last many decades, depending on the quality of the material, maintenance, and exposure to the atmosphere. Galvanized iron requires regular painting to avoid corrosion. Split seams must be resoldered. Metal surfaces, such as copper, can become pitted and pinholed from acid rain and generally require replacement. Copper, lead-coated copper, and terne-coated stainless steel are favored today for long-lived roofs especially for those in inaccessible or seldom-inspected locations.

Routine Inspection

According to the National Roofing Contractors Association/Asphalt Roofing Manufacturers Association (NRCA/ARMA) Manual of Roof Maintenance and Repair, the greatest cause of premature problems on flat roofs is the failure to find and correct minor defects and deterioration in their early stages.

Inspections by volunteers or building staff should take place at least twice a year, preferably in the spring and fall, recording and reporting all changes in the condition of the roof. Look for the following conditions:

- roof surface problems such as blisters or bubbles, worn surfaces, open seams, visible cracks, ruptures or other holes, and loose surfaces or fasteners;
- drainage problems such as standing water, clogged drains and gutters, and bent or missing drain covers;
- flashing problems including cracks, holes, rust, missing flashing, and failed caulking at joints between flashing and parapet walls;
- masonry problems on parapet walls such as deteriorated mortar joints, brick, and coping stones; and
- accumulation of debris such as old roofing materials and household garbage.

It is also important to check the roof during and after a heavy rain to see how water is being drained away from the building and if gutters and leaders are clogged. In addition, check the underside of the roof, especially the edges, from the attic for detection of leaks.

Maintenance and Repair

Should a problem be discovered during inspection, the correct diagnosis and its prompt repair will save money by prolonging the life of a roofing system. Repair punctures, worn bituminous coatings, open seams, failed flashings, and other problems before serious leaks develop. Once a roof leaks, damage to the building becomes costly to repair. For example, wet insulation boards and rotting decking require roof replacement. If an accumulation of water is discovered, a roofing contractor can increase the slope of the roof by installing insulation boards over the wood decking.

Any temporary in-house repairs or professional roofing work should be completed before winter. Some temporary repairs to roll asphalt or modified bitumen roofing can be performed by maintenance crews or volunteers. However, it is important to avoid the indiscriminate use of bituminous patching compounds (such as roofing tar) for repairs. These temporary repairs can be harmful to building materials and difficult to remove at a later date.

Flat roofs are frequently used as platforms for mechanical equipment, signs, and braces, where improper mounting and flashing causes leaks. Avoid using the roof as a staging area for parapet, steeple, or mechanical repairs, where workers can be careless about protecting the surface.

When to Repair or Replace?

Many congregations try to extend the life of a flat roof by continually repairing the surface. This decision may ultimately cost more in the long run due to increased staff attention and damage caused to interiors and structural systems. According to the NRCA/ARMA Manual, roof replacement is recommended when the roof has exceeded its expected service life and shows evidence of advanced deterioration: insulation is wet, deteriorated, or poorly attached; or numerous leaks of a serious nature have developed in the roof membrane. Replacement, rather than recovering the old roof with a new membrane, is also necessary when the existing roof membrane is not a suitable substrate for a new roof covering, or two or more roof coverings already exist.

Contracting for Roof Work

Before hiring a contractor, documents should be prepared by an architect or engineer. Choose a building professional who can provide you with clear guidance on the pros and cons of various roofing systems suitable for your situation. Design a system with built-in back-ups for failures that can be noted during inspection and fixed before leaks occur.

Always try to obtain at least three comparable bids from qualified roofing contractors with extensive installation experience and a reputation for good workmanship. Be sure to have your architect or engineer supervise the work. Every precaution must be taken to protect the building, workers, and the public from serious fire hazards involved with the use of propane torches, hot tar, and the like. Further guidance on contracting for roof repairs is contained in previous issues of *Common Bond* (see Resources).

Acknowledgements: John F. Bero, Bero Associates, Rochester, NY; Dennis M. Firman, PE, "Maintenance Needs: An Owner's Perspective," *Professional Roofing* (August 1990); Wesley Haynes, *Inspecting and Maintaining Religious Properties* (New York Landmarks Conservancy, 1989); *NRCA/ARMA Manual of Roof Maintenance and Repair* (National Roofing Contractors Association/Asphalt Roofing Manufacturers Association, 1988).

The Dreaded Black Goop

No matter what type of roofing system is on a building, every religious institution has a bucket of bituminous roofing compound (known as "roofing tar" or "black goop") that is used to patch leaks in parapets, coping stones, flashings, valleys, gutters, and other areas. This is not the appropriate way to correct a leak since tar hides the true condition of the underlying roof and masonry, corrodes metals, and can be difficult to remove for proper repairs. Furthermore, the tar deteriorates due to exposure to sunlight, loses its adhesive qualities, and begins to crack after a year of seasonal weathering. These cracks permit water infiltration that can cause damage to decorative interiors and masonry parapet walls. Therefore the use of roofing tar can only be considered a temporary measure to stop a leak during winter months or when funds are not immediately available for proper repairs. It is more cost-effective to address the cause of leaks rather than hide problems under roofing tar.