

MAINTENANCE GUIDEBOOK V

ROOF AND WATERPROOFING MAINTENANCE MANAGEMENT

CHAPTER THREE - ROOF AND WATERPROOFING MAINTENANCE MANAGEMENT

SECTION A GENERAL

Roof systems are complex, waterproofing assemblies, designed to protect the building and its contents from water infiltration and damage. Most roofs include insulation for energy conservation and to serve as a substrate for drainage slopes and roof membrane. Roof-mounted mechanical equipment has special curbing and flashing to waterproof the installation. Parapet walls and pipe penetrations require flashing or booting. All these items should be maintained, or premature failure can occur. Some of the causes of premature failure include the following:

- Lack of roof maintenance;
- Improper or incomplete roof design/construction;
- Incorrect use of materials;
- Improper material storage during the original installation or subsequent repairs;
- Extreme climatic conditions—wind, rain, hail, snow, ice;
- Improper modifications or attachments;
- Inadequate drainage;
- Damage resulting from other construction and vandalism;
- Foot traffic;
- Installation of antennae by residents;
- Foreign objects.

SECTION B ESTABLISHMENT OF ROOF AND WATERPROOFING MAINTENANCE PROGRAM

The causes of roof failures mentioned above, and others, highlight the fact that all roof systems require some degree of maintenance to ensure that the roof does not fail prematurely. Small defects should be corrected before they become more extensive and expensive repairs. An effective roof-maintenance program involves the implementation of scheduled inspection and necessary corrective action.

The roof inspection and maintenance program should be aided by a periodically updated Historical Data File.

SECTION C HISTORICAL DATA FILE

Each HA building should have a Historical Data File (HDF), which should be created when the roof is installed. If HDFs were not created initially, they should be created as soon as possible afterwards.

The HDF generally contains the following:

- As-built drawings and specifications showing the locations of penetrations, roof-top equipment, and flashing;
- Material manufacturers' brochures, specifications, and application instructions;
- All inspection checklists, including reference drawings, reports, and correspondence;
- Names, addresses, and telephone numbers of roofing and waterproofing contractors who are responsible for the initial installation and any subsequent repairs;
- Warranty information, including the following:
 - Date of acceptance of the roof installation;
 - Applicator's warranty and expiration date;
 - Manufacturer's warranty, expiration date, and terms (make particular note of owners' responsibilities and acts that can void warranty);
- Record of any changes made to the roof, including addition of mechanical equipment;
- Records of past problems and corrective actions—for example, repair work orders and leak reports;
- A Historical Roofing Record (see Appendix A) to be kept on top of the file. This will provide a ready reference for important information relative to the "as-built" roof construction;
- Prints of reproducible plan and blank roof-inspection forms (see Appendix B) for use in subsequent inspections.

SECTION D WARRANTIES AND REPAIRS

1. WARRANTY

One of the most important things the HA should do is to obtain, read, and understand the manufacturer's warranty for the roof system installed. A warranty is a contract between the HA and the manufacturer which can be voided if its stipulations are violated. Some common occurrences which may result in a voided warranty include, but are not limited to, the following:

- Neglect of roof system by not performing inspection, repairs, and routine maintenance in a timely manner (having a warranty does not mean that the HA can forget about the roof);
- Failure of the HA to notify the manufacturer of leaks in the roof system in a timely manner;
- Failure of the HA to notify the membrane manufacturer of work required to repair damage or to add roof-top equipment;
- Failure to have permanent repairs or maintenance performed in accordance with

manufacturers' instructions such as:

- Use of materials not manufactured by the warranting manufacturer, or use of incompatible material for repair;
- Work performed by contractor not approved or authorized by manufacturer to perform such work.

2. REPAIRS

The importance of having repairs made by qualified contractors in accordance with the membrane manufacturer's recommendation, whether or not the roof is under warranty, cannot be overstressed. Use of incompatible materials can result in accelerated deterioration of some membranes and may result in short-lived repairs. Only the most basic repairs should be performed by HA staff unless they are skilled and properly trained roof mechanics.

SECTION E INSPECTION TECHNIQUES AND EQUIPMENT: GENERAL OVERVIEW

1. VISUAL INSPECTION

Roofing and waterproofing inspections are normally visual, which enables the inspector to readily identify the results and sources of the defects. Visual inspections, however, are not always conclusive and testing is sometimes necessary.

2. WATER-TESTING

Water testing is a leak detection method that uses a garden hose to help identify leak sources in both roofs and waterproofing. The roof is flooded, or the flashing and masonry are sprayed, until water appears at the interior of the building. Water-testing requires practice and patience, has some distinct disadvantages, such as property damage if not properly conducted, and may not be effective for every roof system, particularly re-cover roof systems.

3. NONDESTRUCTIVE TESTING

There are several forms of nondestructive technology that can assist the HA in determining the condition of the roof. Most HAs, however, have no ready access or the knowledge to use the specialized equipment required. The following information is provided about the availability and use of nondestructive testing methods. When extensive repairs are required or replacements are

considered, the HA should consider contracting for one of the test methods listed below. All methods produce data that must be correlated with test cuts in the roofing system.

a. Infrared (IR) Thermography

IR equipment can locate wet insulation by detecting the thermal differences that occur between areas of wet and dry insulation during certain times of the day. Thermal differences (anomalies) detected by IR equipment produce an image on the instrument monitor. Moisture in wet areas normally shows as a light-shaded area; dry insulation is indicated by dark-shaded areas. The IR image is formed by energy radiating from the various materials and should be interpreted by a skilled operator. Due to interference from other forms of radiation during daylight hours, the IR scan is best conducted at night.

b. Nuclear Moisture Meter

The nuclear moisture meter detects moisture in the insulation by measuring the difference in densities of hydrogen ions between the wet and dry areas of insulation. Readings are taken in a grid pattern, and through statistical analysis and interpretation of the readings, a contour plot is developed which outlines the wet areas.

c. Capacitance Meter

The capacitance meter measures the differences in dielectric constants that occur between wet and dry areas. The application and interpretation of results is similar to that of the nuclear moisture meter.

SECTION F REPAIR VERSUS REPLACEMENT—THE OPTIONS

1. GENERAL

Every roof system ultimately requires replacement. While the main purpose of this guidebook is to serve as a guide for extending the useful life of roofs by proper maintenance and repair methods, it is of equal importance to determine when such treatments are no longer economically feasible and reroofing is necessary. The alternatives for correcting defects in roof systems include the following:

- Preventive maintenance;
- Repairs;
- Re-cover roofing;
- Replacement.

The decision to repair or replace a roof is based upon several factors, including existing condition of the roof, economics, and availability of in-house resources.

2. PREVENTIVE MAINTENANCE

Preventive maintenance consists of scheduled procedures for correcting minor deficiencies to extend the life of the roof system like periodic (semi-annual) inspections, replacing defective or missing shingles, removing leaves and foreign objects from gutters, and ensuring that deficiencies noted during inspections are corrected.

3. REPAIRS

Roof damage resulting from weather conditions, abuse, and other causes are corrected through repairs. The basic techniques for accomplishing repairs for different roof systems are contained in Chapter Four of this guidebook. The repairs should be completed in accordance with good roofing practice and with materials compatible and designed for use with the type of roof system being repaired. The repairs should not be performed when the roof is wet or when precipitation is predicted. Most repairs can be performed by HA forces. There are cases, however, when contract work is warranted. The decision to perform an extensive and costly roof repair should be based on an economic analysis comparing the life-cycle cost of repair versus replacement, and availability of funds. The repair should correct both the cause of the problem and the deficiency itself, otherwise the deficiency will recur.

4. RE-COVER ROOFING

Re-cover roofing is a new roof system placed over the top of an existing roof. This alternative is not suitable for every condition; therefore, it should be avoided if at all possible. The following conditions should be met, and disadvantages and advantages considered, before deciding to install a recover roof.

- The insulation, if any, must be dry. Insulation with entrapped moisture must be located, removed, and replaced with similar dry materials. Generally, nondestructive moisture surveys are used in determining the extent of wet insulation.
- The existing roof-system components must be well attached to each other and to the structural deck. Unattached materials in localized areas should be mechanically fastened to the structural deck.
- The surface of the existing membrane should not have excessive blisters, patches, ridges, fishmouths, membrane irregularities, or abrupt changes in elevation.
- Existing flashing conditions should accommodate the added thickness of new roofing without

extensive work.

- The existing structure must be able to safely carry the added weight of the re-cover roofing system.
- The existing roof cannot be a previously installed re-cover roof.

a. Advantages

The advantages of re-cover roofing include the following:

- It is less expensive than complete tear-off and replacement of the existing roof;
- Unless the required surface preparation is unusual, construction time is shorter than for tear-off and replacement;
- The thermal value of the existing roof is kept, since it becomes part of the system.
- Roof insulation can be added to provide greater insulating values or better slope conditions; however, the amount of additional insulation will be limited by existing flashing heights.

b. Disadvantages

The disadvantages of re-cover roofing include the following:

- Much lower life expectancy than for tear-off and replacement;
- Preparation of the existing roof system might become more extensive and expensive than anticipated, requiring contract change orders.
- A defect, such as nonattachment or moisture within the existing system, may adversely affect the performance of the new roof.
- If insulation is added over the existing system, the existing membrane functions as a vapor barrier, and condensation problems may develop.

In general, after all preparations required for re-cover roofing are made, better and more long-term results can be accomplished by repairing the existing roof, often at a much lower cost.

5. REROOFING BY REMOVAL AND REPLACEMENT

At the end of their lives, shingle roofs become excessively brittle and built-up, and other flat-roof systems show acute signs of deterioration, warranting the need for complete replacement. There are times prior to this, however, when due to premature deterioration, the advantage of complete roof replacement needs to be considered.

a. Advantages

The advantages of removal and replacement include the following:

- Exposure of structural deck when roof coverage is removed permits a close inspection and repair of defects;
- No wet insulation remains in the roof;
- Roof insulation can be added for increased insulating value to meet current requirements or for improved slope for positive drainage;
- Flashing problems can be corrected.

b. Disadvantages

The disadvantages of removal and replacement include the following:

- The construction time is longer than for repairs or re-cover roofing.
- Dry insulation removed is wasted. However, under certain conditions, the existing insulation can be reused.

Several factors need to be considered before a decision is made to replace a roof, such as its condition, age, and the frequency and cost of previous repairs. The latter data should be found in the Historical Data File.

SECTION G REPAIR VERSUS REPLACEMENT—THE COST ANALYSIS

Generally, cost estimates and life-cycle cost comparisons are used for determining if the roof should be repaired or replaced. The following is one of several methods for life-cycle costing techniques.

1. DETERMINE FEASIBILITY

First, decide which optional methods are technically feasible for a given roof. The HA should evaluate the roof condition, extent of leaks, environmental factors (asbestos), and anticipated costs. Depending on the size of the HA and circumstances, it may be necessary to contract out such an analysis. The following options should be considered:

- Accomplish repairs now, reroof at a later date.
- Reroof by removal and replacement now, including provisions for upgrading the existing system by adding insulation, improving drainage, removing abandoned equipment, installing new curbs, and installing new flashing.
- Reroof by removal and replacement now, with a different type of system, such as single-ply, or modified bitumen.

- Install a re-cover roof. Consider the disadvantages of not recognizing bad conditions of the existing roof below the re-cover roof membrane.
- Replace problematic flat roof with pitched roof.

2. PREPARE COST ESTIMATE

Prepare a cost estimate for each option. All aspects of each option should be considered. For instance, special handling equipment (cranes, hoists, chutes), or extraordinary substrate preparation for a particular system. (Some systems require complete, 100 percent removal of the existing roof system, such as mopped-down vapor barriers, while other systems require removal of only "loose" material.)

3. DEVELOP LIFE-CYCLE COSTS

Develop a life-cycle cost for each option considered by extending the costs over the expected life of a new roof (typically 20 years). The cost of all options should be analyzed over the same period including anticipated additional repairs for other than complete replacement options. Such additional repairs may include recoating smooth-surfaced membranes, and other anticipated repairs for each type of system.

The life expectancy of repairs should be based upon the existing condition of a roof to be repaired, the extent of repairs to be made, and the understanding that additional repairs may be required later. Life expectancy of a re-cover roof should be based upon thorough knowledge of the existing roof, the manufacturer's literature, and actual field experience with similar re-cover roofs.

All life-expectancy figures require sound engineering judgment and thorough knowledge of the existing conditions over which the repair, re-cover, or replacement roof is considered.

4. COMPARE OPTIONS

Next, compare the options and decide which one is the most economical to choose. The final selection should be made on the basis of economy and availability of necessary funds.

SECTION H HIRING A ROOFING CONTRACTOR

The National Roofing Contractors Association (NRCA) publishes a bulletin entitled "Insist on a Roofing Professional." The HA may contact NRCA, 10255 West Higgins Road, Suite 600, Rosemont, Illinois 60018 (Phone 708/299-9070) for a copy of the bulletin, when considering hiring a roofing contractor.

The following areas should be considered when evaluating roofing contractors:

- Experience with specified roof system;
- Well-established track record (contact past clients for references);
- Insurance and bonding capacity;
- Financial solvency.

END OF CHAPTER THREE