

Introduction

Objective

The objective of this manual is to provide a method which will allow people involved with maintenance to periodically check the condition of various parts of the exterior enclosures of school buildings. If this type of inspection is performed on a regular basis, minor problems can be corrected or repaired before they become major capital expenditures.

Many materials such as roofing and sealants have an anticipated or known service life. If these materials are inspected and found to be near the end of their usefulness, replacement work can be scheduled in a timely manner. Without the warning notice from a periodic inspection, the replacement work would have to be done as an emergency repair and would likely be rushed and less than satisfactory.

It is hoped that this manual will also provide some knowledge of the relationship between parts of a building. What may appear to be a very minor opening in a wall or roof may actually be a serious problem such as the case where water, entering into a wall system through a small hole in flashings or a coping, will cause the steel frame to rust. The steel will expand and force the brick wall face to become displaced and possibly fall.

Scope of Manual

The scope of the inspections and parts of the building systems noted in this manual are confined to the exterior enclosure of a school building. Although electrical or mechanical systems are often found on building exteriors, they are not discussed except where they may be a possible route for water to enter the building.

Materials and systems noted in the manual are those commonly found in typical school buildings. It would be impractical to try and include all the materials that could possibly be used in a building. Many of the older buildings may have materials such as slate or copper roofs which are rarely used on the newer schools. These materials will have to be considered as a special category.

Use of Checklist

Checklists for major building elements are found at the front of each chapter of the manual and are followed by descriptions of the parts and materials which make up the building element.

Each of the checklists is divided into major parts of the building element such as "Roof Membrane/ Base Flashing, Built-up Roofing" or "Wall Surfaces". Below these divisions are itemized lists, which are to be used to indicate the presence of problems and the condition of the materials. If the item in question is not present on the building, check the box "NOT PRESENT" and skip to the next item.

The presence of problems at the "Base Flashing", for example, is indicated by Yes/No answers which would report that problems such as bridging or gaps/splits/cracks are present in the flashing around the edge of the roof. This identifies the type of problem and alerts the other personnel to possible remedial work.

Below each item is a space to report the condition of the item. This is where the degree of damage or priority of the repair is indicated. Here three possible types of action are listed:

- **IR - Immediate Repair Needed** - This priority would be used where there were breaks in the flashing and water was able to enter in below the membrane or into the wall system. Here repairs might have to be in the form of a temporary patch to prevent water entry until a permanent repair can be made.
- **NI - Check During Next Inspection** - A lower priority that would indicate a possible problem, but one without actual water entry. When the flashing membrane is stretched out above the roof deck at a base flashing situation, the roofing is intact and watertight, but a failure is likely in the near future. This priority is used as a reminder to carefully look at the condition during the next inspection.
- **OK - No Problems Noted** - This notation indicates that the part of the building has been inspected and that no problems were found.

In filling out the checklist one should always be thinking that it will be read and interpreted by other people who will be evaluating the condition of the building and planning for future maintenance and repairs. Your notations must be understandable and clear to the next person who might be inspecting the building.

End of Introduction

Chapter 1 - General

Major Elements

Schools are constructed with the following major elements which are common to almost all types of buildings:

- **Foundation** - The walls on which the structure rests, usually concrete below the grade.
- **Frame** - The skeleton of the building, typically steel but may be concrete.
- **Exterior Wall** - The enclosure which keeps the weather out of the building. Brick masonry is used most often, but light metal panels or glass in a metal frame are also common. The complete wall system consists of the exterior facing, a backup structure (typically concrete block), and an interior finish such as dry wall or plaster.
- **Roof** - Like the exterior wall, a part of the enclosure to keep out weather. A roofing membrane acts as the waterproofing portion of the roof system. This is usually applied over an insulating board which is fastened to the roof structure or deck. The deck is usually concrete or steel but may be a panel system.
- **Windows** - A part of the exterior wall which is used to provide daylight to the interior and, when operable, to provide ventilation.
- **Bulkhead (or "penthouse")** - A small structure built over the main roof of a building, usually to house mechanical equipment or stairs.

Function of Building Enclosure

The function of the building enclosure is usually defined as that part of the building which is designed to protect the interior from the weather. It also functions as the security barrier for the building.

As weather protection, the enclosure must prevent water from entering into the building. This is done by providing waterproof walls and roofs that will shed water and not allow the inner portions of the walls and roof to become wet. Not only must the interior of the building be kept dry, but it must also be kept warm in the winter, and where the air is conditioned, cool in the warm months. This is a function of the insulation which is built into the exterior enclosure.

Security is provided by the strength of the exterior enclosure. Both wall and roof must be able to withstand forced entry. In both cases the weak points of the enclosure are the openings for light and access. Roof hatches, windows and doors must be maintained to prevent unauthorized entry. At the same time they must be available as means of exit.

Interconnection of Building Parts

The building enclosure is made up of a great many parts and different materials. All of these different elements must in good condition and work together in order to be an effective weather barrier.

Materials on the outside of an exterior wall or roof are selected because they resist water, while those on the interior of the enclosure are usually susceptible to damage if they are allowed to get wet. As an example, insulation placed in a wall or below

a roof membrane will be useless when wet. It not only loses its insulating value, but it will retain water which will eventually damage both the roof membrane and the deck structure.

A frequent problem is the failure of joints in a parapet cap or coping. Whether the coping is masonry or metal, what may appear to be a small failure of a joint will allow water to enter into the parapet wall where over a period of time it will do considerable damage. Water will be able to work down behind the roof flashing and in below the roof membrane or the water will migrate down into the exterior wall. Here the problem occurs when the steel framing becomes wet and rusts. The formation of rust on steel causes it to expand. This in turn will cause the exterior wall facing to be displaced outward. Repairs to the roof system and to the exterior wall are far more complex and expensive than the minor remedial work on the coping joints.

A damaged or missing downspout does not usually appear to be a problem since the water from the roof will continue to flow down the wall. However, the wall will be damaged by the concentration of water in a small area. In a short time, mortar will be washed from joints in the masonry and soon water will enter into the wall.

It is not unusual to find that steel rods or bolts have been inserted into the masonry cladding of an exterior wall. Many times these anchors are no longer used and have been cut off at the face of the wall. Without the protection of a paint coating or a sealant cover, the steel will rust and damage the masonry when the steel expands. This will allow water to enter the wall.

Interior surfaces are often damaged by water entering through an open window but damage can also result when the window is closed. If the sealant between the window frame and surrounding masonry is in poor condition or the weatherstripping on the sash has failed, water will enter the wall system and damage the interior finishes.

If repairs to one portion of the building are not made correctly, other materials can be damaged. Resecuring aluminum flashings or copings with steel nails will cause the nails to disintegrate from the galvanic action of the dissimilar metals, leaving openings for water entry.

Establishment of Priorities

When water is running down from the roof and into the light fixtures it is obvious that the repair of the roof has a very high priority, but often what appear to be minor problems should also have a high priority. It is important to recognize that extensive damage may result from what looks like a very minor problem that could easily be deferred.

A case in point is the damaged or missing parapet cap that will allow water to enter the wall system and cause major damage. The resulting rusting steel and deteriorating wall ties are major items of repair.

Another example would be a damaged or broken piece of hardware which is usually not considered a high priority. However, if a door or window will not close securely, it is likely that water will enter the system. Typically, the door becomes damaged from water flowing into its interior, but damage also occurs when water gets in behind window frames when the sash does not close tightly.

Missing coping covers and downspouts, as mentioned before, are typical of items which must be immediately replaced in order to prevent further damage to the building enclosure.

Priority should always be assigned to areas of damage where there is evidence that the amount of damage will increase if the problem is not rectified. If a brick facing is bowed out of the plane of the exterior wall, there is a probability that the ties between the facing and the back-up have failed. Unless this sort of situation is corrected promptly, further damage will result as more water enters the wall through open joints and the rusting of the wall ties continues to a point of complete failure.

End of Chapter One