Waterproofing Problems: A Simple Explanation, A Simple Solution

The purpose of this paper is to point out the underlying causes of waterproofing problems and simple means of preventing them. Such problems are common to hundreds of buildings we have inspected over the past 35 years.

**Horizontal Surfaces**

**Copings**

In our experience copings and parapet walls are the cause of at least 80% of the waterproofing problems we have observed in all types of construction.

I. Masonry Copings: Where a permeable coping is to be used, a through the wall flashing below the topmost unit is a must. Note: A through the wall flashing being a "dissimilar material" can cause mortar cracking due to expansion rate differential. The joint in the face of wall should be caulked with an elastomeric material to accommodate this movement.

II. Mortar Copings ("Mud Cap"): A mortar "coping" is totally ineffective and is guaranteed to leak and should not be used on a building wall. If one must be used such as atop a site wall, the mortar should be mixed with latex concrete adhesive to minimize cracking and insure adhesion to the masonry units.

**Roofing Cap**

Roofing cap sheets over a "mud cap" is equally ineffective for two reasons:

I. The roofer usually stops his application at least two inches from the top face of the wall to prevent bituminous material being slopped onto the wall surfaces. The resulting two inch "no mans land" will easily crack and leak.

II. The cap sheet will "fish mouth" due to expansion and or contraction, allowing water to enter contributing to roof and wall deterioration and leaks.

**Sheet Metal Caps**

A well-designed properly installed sheet metal cap is the answer to preventing most masonry wall leaks. The following are common deficiencies in sheet metal caps and their solutions:

I. "Skirt too short". For proper protection the sheet metal must extend a minimum of two inches over the masonry surface front and back. In practice three inches is preferred to allow for normal tolerances. This is particularly important when using split-face units to avoid wind driven rain being blown up under the cap. Note: Detailing of a metal cap with a two-inch "skirt" does not provide the necessary minimum two inch cover. A four-inch skirt might, a five-inch skirt will. We often find a 2 to 2 1/2 inch skirted cap nailed to 2 x 4- rough lumber, and therefore only 1/2 inch or less of the cap extending over the masonry. To compound the problem the cap will be sloped to the roof side thus
raising the skirt in front. The result is that we have the bottom edge of the cap level with the top of the masonry and a wall that is guaranteed to leak. (Hopefully we have roofing installed on the backside of the parapet wall.)

II. Joints in the Cap: Expansion and contraction of the sheet metal will defeat the most carefully planned and executed cap joint that relies on caulking for its seal. In our experience the standing seam cap has been 100% effective in preventing problems. (Providing of course that it is installed with a slight slope to the roof to prevent a "dished" horizontal surface and that the seam is tall enough). Do not allow the cap to be installed by nailing through the top! One "little hole in a cap is like one "little hole" in a roof or a swimming pool!

**Rakes**

Rakes should definitely be avoided if possible. If you must design a sloped masonry surface consider it as critical as a horizontal surface and consult with a responsible waterproofing manufacturer for advice on special treatment.

**Projections or Recesses**

Again, avoid horizontal surfaces of any dimension whenever possible. A void a water table being held against mortar joint or masonry units. a. Pre-cast canopies. Sunscreens, should be caulked to adjacent vertical masonry wall surfaces. Caulk application should extend upward 1-1/2 inches. A better treatment is polyester or glass fabric embedded in paintable waterproof mastic. This treatment can cover entire top surface of pre-cast unit for weatherproofing protection and act as a flashing to wall surface.

**Sills**

Masonry sills should be avoided.

**Vertical Surfaces**

Again we first look to the topmost portion of the wall for the most frequent cause of waterproofing problems.

**Parapet Walls**

An often-overlooked source of water entry common to all building materials, the parapet wall is unique in that it is the only part of the building being subjected to the weather on both sides. Consider the temperature differentials on an East-facing wall on a sunny cold morning. The expansion/contraction forces are "torqueing" the parapet wall and can cause mortar cracking. Add to this the fact that since very few people ever see the back of the parapet wall the mortar tooling is often substandard.

Fortunately the solution is simple. Provide for a positive membrane waterproofing of the roof side of the parapet wall. If the exposed area is too tall for a conventional roofing material, provide for a fabric reinforced mastic system or other membrane from the top of the wall down to and at the counter
flashing. (By extending the membrane onto the counter flashing we gain free insurance against possible problems at the wreglet.)

**Multi-Level Parapet Walls**
The intersection of the horizontal top surface of a lower wall with the edge of a taller parapet wall is common cause of leaks due to inadequate caulking or flashing (or none at all). (This is also an excellent location for a control joint in the wall!)

**Mortar Joints**
The proper detailing, mix, installation and tooling of mortar have been exhaustively treated in other documents. For purposes of this paper we will deal only with common deficiencies encountered in the field. However, to emphasize the importance of sound mortar joints let us point out that in a concrete block wall the mortar joints represent almost 10% of total wall surface area; in a slump block wall they represent over 11% of wall area. To depict this more graphically let us consider a hypothetical concrete block building 100' x 100' x 23' high. The wall surfaces area will be approximately 9,200 square feet - the mortar joint surface area will equal approximately 900 square feet representing 20,700 lineal feet of joints. Would it be anticlimactic to say that sound mortar joints are extremely important to the construction of a waterproof wall?

The following are mortar joint problems sometimes encountered in the field:

- **Insufficient Depth**: To be sound a mortar joint must be installed to the full thickness of the face shell of the masonry unit. Note also that insufficient joint thickness coupled with insufficient joint depth during a dry windy weather condition results in an uncured crumbly joint, which is impossible to waterproof.

- **"Bee Holes"**: Bee holes are often the result of insufficient joint depth. Often a very small bee hole is merely a preview of a very large void behind it. A small hairline crack at the junction of head and bed joint is also sometimes an indication of a void behind. Probing with a knife or other tool will usually confirm this weakness if it exists. A profusion of bee holes would suggest the advisability of a fight sandblasting to expose hidden deficiencies in mortar joints.

- **Joints in Scored or fluted Block**: These joints are a little more difficult to tool properly and being more difficult they sometimes are not tooled properly. Proper tooling is absolutely necessary to insure adequate compression of mortar to achieve required density and good adhesion to masonry units.

- **"Remedial Pointing" of Mortar Joint Deficiencies**: Proper pointing of voids requires opening the void and filling it to full-face shell depth. A cosmetic skinning over of a hairline crack or bee hole with mortar cannot be effectively waterproofed. However, if a minimal amount of bee holes or hairline cracks exist they can be effectively sealed with a waterproof caulking material tinted to match the masonry. In any
case where voids are discovered after application of clear waterproofing it is always preferable to seal them with waterproof caulking. Repairing the voids with mortar would be analogous to filling a hole with a sponge insofar as waterproofing is concerned.

Cracks: A small amount of cracking is unavoidable in any type of construction. An understanding of the causes of cracks is helpful in preventing them. Expansion and contraction of roof, wall and floor systems is the most common and least understood of the causes of wall cracking. Most masonry wall cracking is the "hairline" variety (in the mortar joints) and can be effectively sealed by a high quality clear waterproofing material.

**Control Joints**: (Expansion/Contraction Joints). This subject is treated in other documents. The following points are important enough to be repeated:

- A control joint is necessary between an interior intersecting masonry wall and the exterior wall to prevent cracking.
- A control joint is indicated at large openings or changes in wall height.
- As a rule of thumb a control joint is usually desirable about twice as frequently as it is normally specified.

**Penetrations**

Wall penetrations are so obvious and yet so often overlooked. For example:

**Scuppers**: When we are called to inspect a leaking new building it's usually evident that scuppers have not been caulked.

**Plumbing and Electrical Services**: You can't drill holes through exterior walls of any structure without creating leaks. These penetrations must be properly flashed (collared) or caulked.

**Electrical Service Boxes** are usually mounted against exterior walls before waterproofing is applied. This provides for a water table against the wall and a joint where water in quantity can flow downward against an unprotected masonry wall.

**Miscellaneous**

The heading "miscellaneous" does not indicate that the following thoughts are less important; only that they do not fit handily into the horizontal or vertical categories.

**Clear Waterproofing Materials**

There are many materials available to you. Consult your concrete masonry manufacturer to determine which ones have the best track record and can offer the most knowledgeable field service in your area. Consult the materials manufacturer to ascertain the best grade of his material for your use.

**Warranty**

Obviously the reputation, responsibility and integrity of the materials manufacturer is important. So also are the above attributes of the applicator. Of equal importance are the qualifications of the
inspector appointed by the materials manufacturer. As with any building material it is always safer to
go with those who specialize.

For technical services, please call Pacific Harmony System (H.K.) Ltd at (852) 2232 5205.