Galvinization on Stucco Lath - Class 1 and G60 Background Paper

Prepared by: William Spilchen P. Eng – Consulting Engineer

May 2015

Steel corrodes in an acidic environment and is immune in an alkaline or basic environment. The degree of acidity or alkalinity is measured on the pH scale where 7 is neutral and values below are acidic and values above alkaline. Examples of a strong acid are battery acid with pH of 0 and of a strong alkaline is liquid drain cleaner with pH of 14.

Further, for conventional corrosion to occur there must be moisture and oxygen. In most parts of the world there is rain or humidity, and the rain and environment is slightly acidic due to air pollution. Therefore, steel for outdoor applications where it is exposed to these conditions must be protected to prevent this corrosion (rusting). Common methods of protection are barrier coatings such as paint, chrome or plastics; or galvanization. Galvanization is an application of zinc coating to the surface of the steel. The coating can be applied by hot dip method into molten zinc bath, by electro plating, or by mechanical plating.

Galvanization functions in two ways to protect the steel. Firstly, it is a barrier coating and seals the steel surface from the moisture and oxygen. Secondly, it is a sacrificial coating and protects by preferentially corroding while protecting the steel. With this second property, galvanization has throwing power and will continue to protect adjacent areas that have no zinc coating. This differs dramatically from the pure barrier coatings where corrosion will accelerate in areas where the barrier is breached.

However, in a corrosive environment, the zinc coating is consumed with time. In a more aggressive environment, the zinc is consumed more rapidly. This is reason that thicker zinc coatings are specified for such environments, which are usually outdoor situations. This would be seen in applications such as fencing, metal building roofing or cladding, power line towers, guard rails, marine locations, etc. The coating designations would be G60 or G90. This terminology means 0.30 oz/ft² each side for the G60 and 0.45 oz/ft² each side for the G90.

Depending on the environment, this zinc can be consumed in 20 to 30 years (or even sooner in more aggressive locations). The result is rusty roof cladding or fencing where the majority of the zinc has been depleted.

This type of environmental corrosion occurs in a relatively weak acidic environment. In a stronger acidic environment, the zinc can be consumed much more quickly. As an example, for testing of zinc coating thicknesses, the sample is dipped in hydrochloric acid. In this case, the zinc is dissolved in a few seconds or up to a minute.

Conversely, in an alkaline environment, steel is inherently protected and no protection is required. An example of such an environment is Portland cement concrete. The pH of such cured concrete is 10 to 11 due to the Portland cement. As stated, no protection is required and embedded rebar is normally not coated and is black. Under these conditions, the rebar will last many decades with no corrosion.

(Continued-2)
However, there are some situations where the alkalinity of the concrete can be affected. Usually, it is a result with the introduction of chlorides. With moisture, the chlorides will form hydrochloric acid. This formed acid then 2 neutralizes the calcium hydroxide which provides the alkalinity, and the corrosion protection is lost. This happens on a micro scale but creates small pockets where protection has been lost. If there is steel in these locations, it will slowly start to corrode. Situations of chlorides can occur near oceans with salt laden air or spray; or on roadways or parkades in regions where salt is applied to roadways during the winter months. In these regions, epoxy coated or galvanized rebar is commonly used to provide added protection.

There is also situations where chemicals with chlorides are added, such as calcium chloride to speed up hardening, or cements with chloride components are used. There are also rapid setting cements, as compared to Portland cements, that also result in low pH environment. Each of these situations are not recommended for stucco applications.

There is another process that lowers pH of Portland cement concrete (including stucco) called "carbonation". Carbon dioxide in the air reacts with calcium hydroxide in the concrete (or stucco) to form calcium carbonate. The hydroxide ion is what creates the alkalinity and when it is converted, the alkalinity is reduced. However, this is a slow process and normally only penetrates to a depth of 1/8" after many years. How does all this apply to stucco? Stucco is usually a Portland cement based material and has all the attributes discussed above. The significance is that the long term protection of the embedded steel lath is also provided by the alkalinity of the cement matrix.

For further protection, the lath is galvanized and has either a Class 1 coating for wire or a G60 coating for expanded metal. The expanded metal has the exposed slits which are not galvanized, but has the remaining zinc to compensate. Welded wire laths may have small areas at the welds with burned zinc. The corrosion protection of each lath type in stucco is similar, due to the throwing power of the zinc to protect.

Aside of zinc coating thickness, proper embedment is important for two reasons. First, is carbonation factor. This is reason for requirements for minimum 1/8" embedment. This is important especially on corners where the nose wire is placed near the surface to act as depth screed. The other embedment issue is at the back surface. With wire laths, complete embedment is easily achieved and the lath is protected by the alkaline stucco matrix. However, with expanded metal laths, it is more difficult to ensure that each strand is completely encased with stucco. In areas where they are not completely embedded, moisture can directly contact the metal without the alkaline protection and accelerated corrosion can occur.

Summary
1. The galvanization of lath is intended for short term protection prior to plastering. This galvanization will provide further protection if corrosive conditions exist at the lath position and the zinc will be slowly consumed. The long term protection is intended to be provided by the proper embedment in an alkaline Portland cement stucco matrix.
2. With the present galvanization requirements for expanded metal laths (G60) and wire laths (Class 1), corrosion resistance is equivalent under similar conditions for each lath type.
3. It may be more difficult to achieve complete embedment with expanded metal laths, and there could be more rapid corrosion as a result if moisture is present at the back side of the stucco.