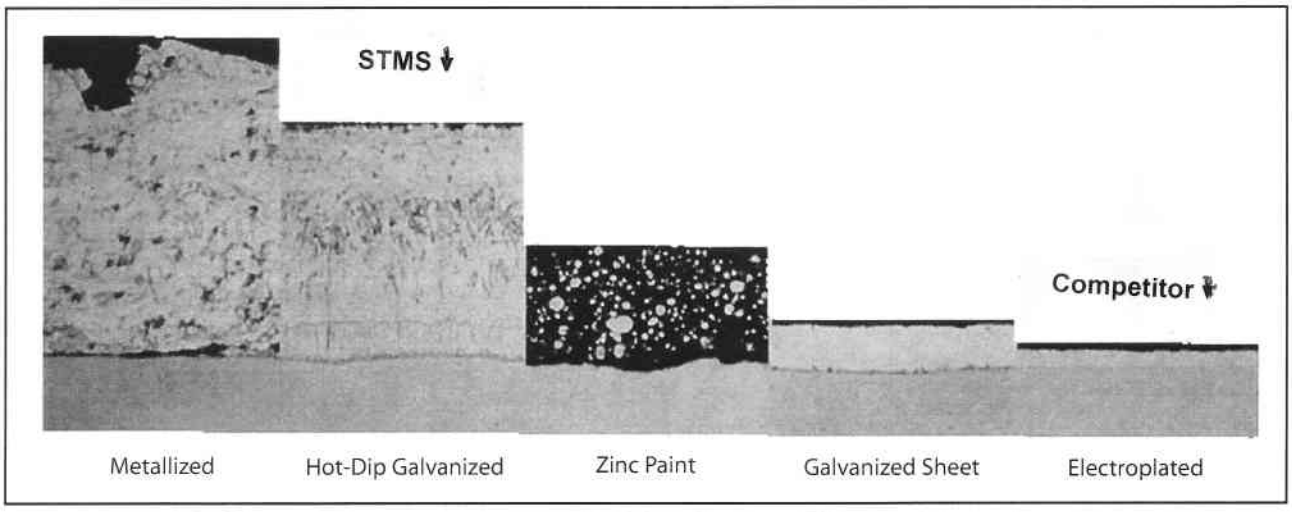
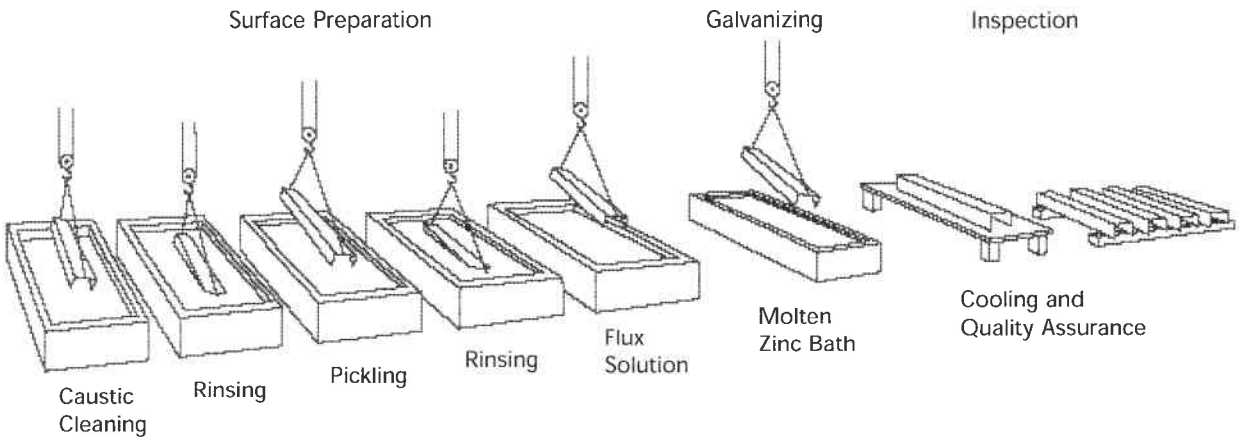
Zinc Coatings



Microstructures of Various Zinc Coatings

Figure 2



HOT-DIP GALVANIZING PROCESS

A proven cost-effective and durable corrosion protection system, hot-dip galvanizing entails cleaning steel in a series of chemical solutions and then immersing the steel in a bath of molten zinc metal. The zinc from the bath and iron from the steel metallurgically combine to form the galvanized coating that protects the underlying steel from corrosive attack. Figure 2 provides an illustration of the galvanizing process steps.

HOT-DIP GALVANIZING — PERFORMANCE CHARACTERISTICS & ADVANTAGES

Barrier & Cathodic Protection

There are two main methods to protect steel from corrosion: barrier and cathodic. Barrier protection simply shields the steel surface from the environment. With the exception of zinc, most coatings - such as paints - provide only barrier protection. Any scratch, penetration, pinhole, or porosity resulting from age, handling or usage compromises the coating and allows corrosion of the underlying steel to begin. Cathodic protection allows an element such as zinc to act as the anodic area on the steel. As the anode, zinc preferentially corrodes, keeping the cathode (base steel) intact. This sacrificial action is also known as "galvanic protection;" only galvanizing delivers an economical combined cathodic and barrier coating protection to steel.

Galvanized coatings' excellent field performance results from zinc's intrinsic corrosion resistance and its ability to form a dense, protective layer on the surface. While fresh zinc surfaces are quite reactive, a thin layer of protective reaction products forms upon exposure to the atmosphere. This stable, protective layer is essential to reducing zinc's corrosion rate, a rate that is approximately 10 to 100 times less than that of steel, depending upon the environment (see Figure 3).

It is important to note that hot-dip galvanized zinc coatings have a much higher density than zinc-rich paint coatings. Specifically, three to six mils (76-152 microns) of zinc-rich paint, depending upon the paint formulation, would need to be applied to equal the zinc content of just 1.7 mils (43 microns) of hot-dip galvanized coating. The lower zinc content detracts from the cathodic protection of a zinc-rich paint system.

Metallurgical Bond

During the galvanizing process, steel is immersed in molten zinc. Through diffusion, the zinc metallurgically bonds to the steel, creating a series of

Figure 3

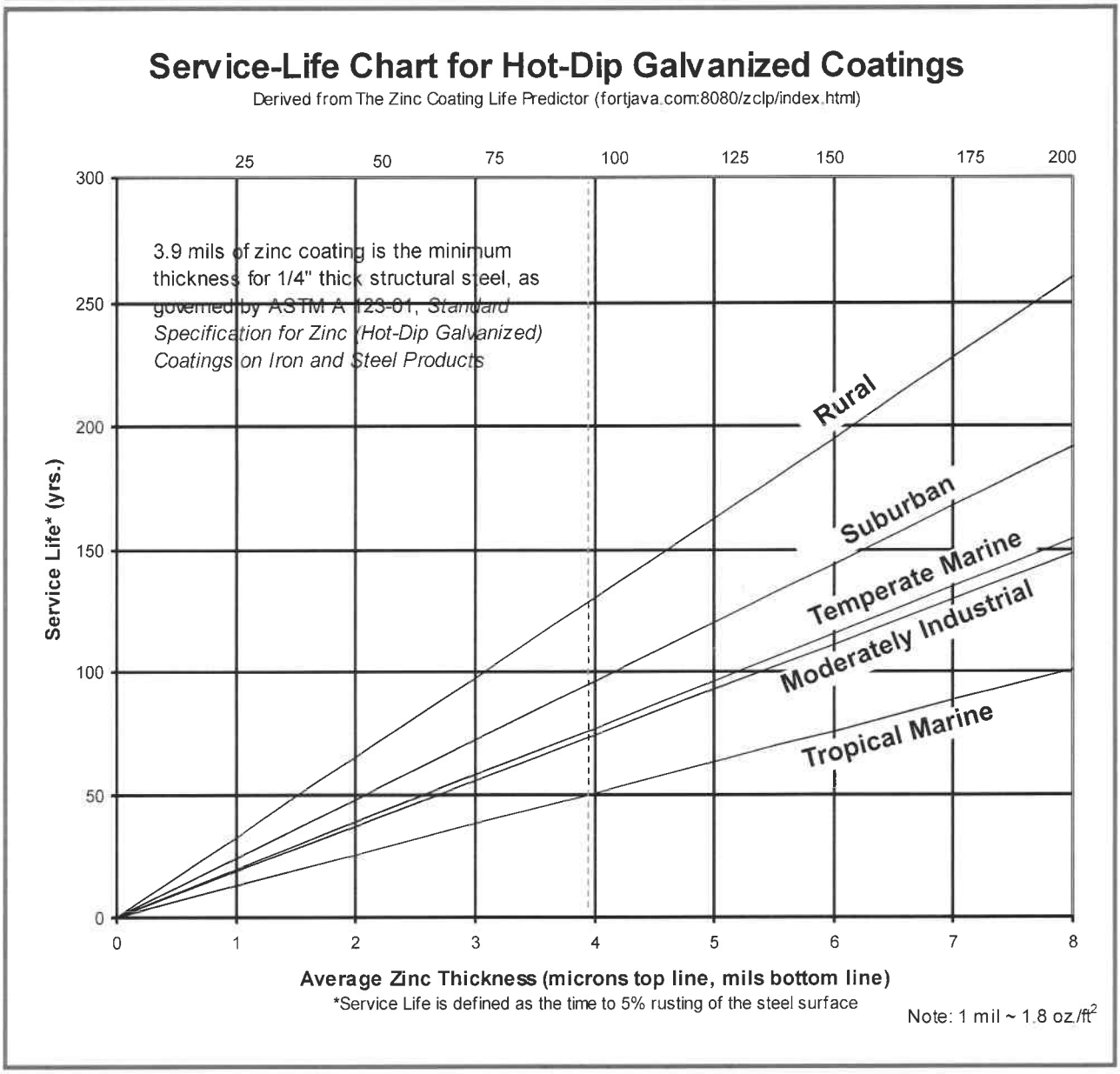
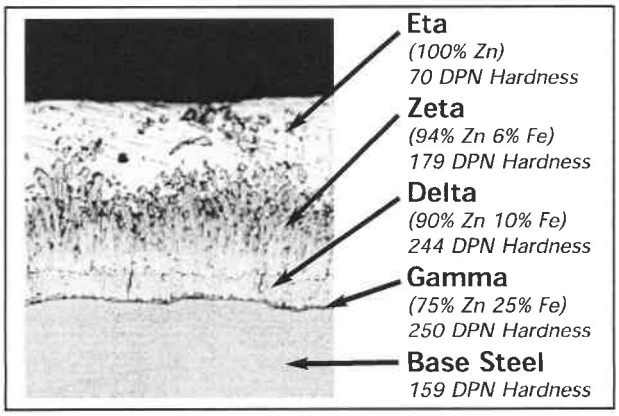


Figure 4



three zinc-iron alloy layers (see Figure 4). The zinc coating's adhesion strength is measured on the order of several thousand pounds per sq. in. (dynes per sq. cm.). In addition, the zinc coating resists abrasion and is as dense as the base steel.

Complete Coverage & Coating Integrity

Because galvanizing is a total immersion process, all parts of the steel fabrication are coated and protected, including areas inaccessible to paint