

DURABILITY OF METAL NOISE BARRIER COMPONENTS

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The area adjacent to a highway is an abrasive, corrosive and harsh environment. It is especially challenging to the durability of metal products. Early in the history of noise barrier construction, many noise barrier panels were constructed of metal due to its low cost, and in some states, metal is still among the most commonly used materials. Perforated metals are used for sound absorptive noise barrier panels. Aluminum is also used in the fabrication of reflective and sound absorptive noise barrier panels. Steel is often used as a post to support noise barrier panels due to its inherent strength and relative low weight compared to concrete posts.

A spreadsheet based upon NCHRP Synthesis #112 study of the durability of zinc coatings in a variety of environmental exposures is presented. The spreadsheet includes an extension of the durability based upon the application of a paint system or powder coating over the zinc coating.

A variety of metal materials coatings and paint systems will be discussed. Problems, case histories, successes and failures will be illustrated and explained.

Noise barrier panels can be made of cold rolled steel or aluminum sheet metal. Cold rolled steel is typically coated with a zinc or zinc/aluminum coating. Zinc coatings are described by their thickness in terms for example, G-90, which means 0.45 OZ of zinc per square foot of metal per side. Thicker coatings provide longer lasting protection, but present challenges to the fabricator of metal products. Zinc surfaces can oxidize affecting the adhesion of paint or powder coatings. Perforating metal exposes the edge of the metal around the interior circumference of the hole. The use of thicker galvanized coating will allow some zinc to "wipe" across the edge of the hole, and the presence of the zinc on surfaces surrounding the hole provide some protection, but it is difficult to measure or quantify how much protection is available.

Coatings on sheet metal panels can be applied in a variety of ways. Coil coated roll formed products such as corrugated sheeting are painted in high production paint lines that clean and chemically treat galvanized surfaces to receive a highly UV-resistant PVF coating over the G-90 or zinc/aluminum alloy surface. It is not possible to apply this type of surface by any other means. Manufacturers of metal buildings will offer a 20-year guarantee against rust on a metal roof with this type of product.

Fabricated metal products are usually fabricated first and painted last. It is not usually possible to shear and bend painted metals without damaging finished surfaces. The surface of a galvanized product can oxidize during transport due to exposure to varying temperatures that causes moisture to condense on the surface. The "white rust" that is created will not allow coatings to adhere to the surface over a long period of time. When painting or powder coating a sheet metal product, the selection of a galvaneal coated sheet metal provides a better paint grip surface and a reduced risk for the appearance of white rust. Galvaneal is a heat-treated galvanized steel that has a rough, paint-able iron-zinc alloy surface. Galvaneal metal is only available as A-40 or A-60 coating with 0.2 or 0.3 OZ of zinc per square foot of surface. Galvaneal is not made with heavier zinc coatings because of the tendency for the thicker coating to break down when bent during forming operations, such as in a press-break.

When powder coating fabricated cold-rolled metal products (including perforated metal) the metal must be cleaned and pre-treated prior to painting so that the paint will adhere to the surface for long life. The pre-treatment can be a dip system in which the panel is lowered into a series of chemical baths, or it can be a series of chemical sprayers. A final rinse should follow and a surface drying heat. If powder coating the product, powder must be uniformly applied and closely followed by baking for the time and temperature that is consistent with the manufacturer's instructions.

Aluminum sheet metal products follow similar painting rules as steel sheet metal except that pre-treatment chemicals must be selected that are chemically compatible with aluminum.

Structural steel products are often used to support noise barriers. Usually steel posts are simply galvanized. They are sometimes made of weathering steel and left exposed. If weathering steel is used, a light brush-blasting with fine black beauty sandblast sand can remove mill scale and exposed a beautiful uniform brown surface. If a colorful post is desired, the post can be powder coated or painted. Well-proven bridge painting systems have been proven over time, including IZEU and OZEU (Inorganic or Organic Zinc primer and Epoxy-Urethane top coat). Most states have complete specifications for bridge paints. In some regions of the country, epoxy rebar coaters have the capacity to handle heavier products and can handle noise barrier posts. They have the ability to shot blast the steel surface and apply a zinc-rich epoxy powder coat, and a TGIC polyester top powder-coat.

For the ultimate protection, the post can be hot-dip galvanized, and then taken to the powder coater. The zinc surface is lightly brush blasted to remove white-rust, and then immediately powder coated with a TGIC polyester coating. This was first done on a NJDOT design build project, which also used aluminum powder coated sound absorptive bridge mounted panels.

After all surfaces are properly fabricated and protective coatings applied, the durability of the surface becomes a function of the environment. The environment includes the exposure to sun, wind, driving rain, snow, ice, de-icing chemicals, salt-lade air, humid conditions, debris, and abrasive grit. The distance from the highway is the most important factor in the longevity of the coating and the product.

The chart that will be presented and explained was developed in the NCHRP Synthesis #112. The added durability obtained by the application of a coating over the zinc surface is explored in the presentation.