GALVANIZING INSIGHTS

FALL 2001

HOT-DIP GALVANIZED STEEL

THE LOGICAL MATERIAL FOR PARKING GARAGES

Several thousand concrete parking garages and over 600,000 concrete bridges in North America are in need of repair at an estimated cost of $200 billion, **four** times the original construction costs! This concrete infrastructure deterioration is the largest civil engineering challenge facing the western world.

In most cases, the concrete is reinforced by bare carbon steel. Unless protected by a coating such as zinc applied in the hot-dip galvanizing process, bare steel will corrode. When chlorides from external sources penetrate concrete, unprotected carbon reinforcing steel corrodes and rust forms. Because rust occupies a volume 4-6 times greater than the original steel's, the concrete cover inevitably cracks, spalls and fails.

STEEL FOR STRENGTH, GALVANIZED FOR LIFE

Zero Maintenance Costs with Galvanized Steel

Given operating expense cutbacks and maintenance budget restrictions, construction design must incorporate competitive, durable, and maintenance-free materials. This is exactly why galvanized steel is the preferred material for parking garages. Used on decking reinforcing steel (see Spring 2001 *Galvanizing Insights*), handrail, sign supports, and a host of other steel products, galvanized steel delivers maintenance-free structures for generations.

Aesthetically Pleasing

Peeling, chipping, delaminating and cracking are all concerns with paint at some time. Advantageously, when hot-dip galvanized steel is utilized in parking garages, not only is there long-lasting corrosion protection, but also a consistently pleasing finish.

Environmental Contribution

When poor concrete performance leads to parking structure repair or demolition, there are three individually significant and collectively staggering areas of cost. The first is the direct cost of labor and materials to remediate and/or replace. This is the largest and most quantifiable cost, and usually the focus of decision-making. The second is indirect and includes parking unavailability, traffic delays, loss of asset and personnel productivity, and stress. Finally, associated with repairs and replacement is the need to drill, blast, crush and transport more aggregate, coal, and iron ore to make, package, and transport construction products. All of these functions require additional, avoidable consumption of energy and natural resources.

With respect to Mother Earth, galvanizing is an industry of recycled materials and process components. Zinc is a naturally occurring element found in abundance worldwide. Zinc is used in a variety of consumer products from lip balms and ointments to toys and cars, and is a recommended part of our diet and is necessary for all human life.

IN THIS ISSUE:

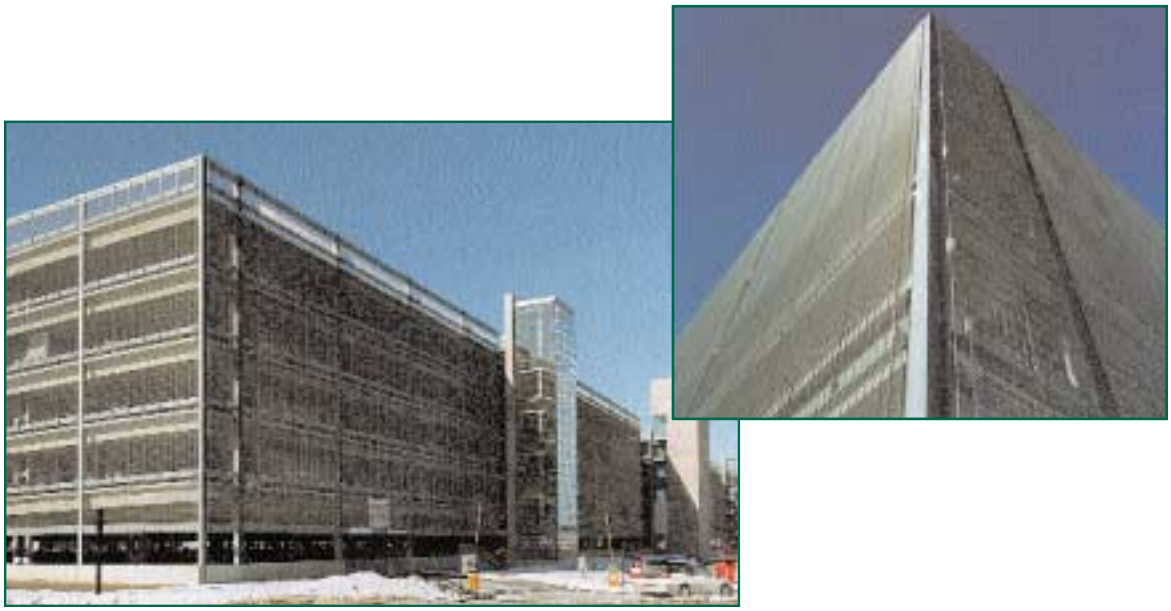
MANCHESTER AIRPORT PARKING GARAGE - A Galvanized Steel Application Report Page 2

ASK DR. GALV? ZINC-COATED FASTENERS Page 3

2002 EXCELLENCE IN HOT-DIP GALVANIZING AWARDS & NEW PUBLICATIONS AVAILABLE Page 4

MANCHESTER AIRPORT PARKING GARAGE

A GALVANIZED STEEL APPLICATION REPORT



SUBJECT

The Manchester Airport Parking Garage is a multilevel structure comprised of 6.4 million pounds (2.9 million kilograms) of hot-dip galvanized steel. Galvanized steel was selected based on its aesthetic appeal, quick turnaround delivery time to the job-site and the maintenance-free performance it delivers on a similar garage built in 1979 in Cambridge, Massachusetts.

LOCATION

Manchester, New Hampshire

ENVIRONMENT

The parking garage is located in a fairly aggressive urban environment where the most recent (20-year) temperature range is from -4 F to 100 F (-15 C to 38 C). With 44 inches (112 cm) of precipitation each year and close proximity to the Merrimack River, the parking structure steel columns and fascia screens must weather the attack of airborne road salts; sulfur dioxide emissions from jet fuel and the highly concentrated automotive and truck traffic; and high relative humidity. With a minimum of 3.9 mils (99 microns) of zinc coating, the galvanized columns will easily deliver 25 to 30 years of maintenance-free protection from corrosion.

DATE OF GALVANIZING

1999

DETAILS

After carefully observing the 20-year, maintenance-free performance of a galvanized steel garage in Cambridge, Mass., the engineering firm for the Manchester Airport Parking Garage chose hot-dip galvanizing for several reasons. The primary decision factor was the elimination of expensive maintenance for the first 25 to 30 years of the Manchester Airport garage structure's life. With smaller maintenance budgets forecasted for future years, the choice of hot-dip galvanizing would free up future budget funds for much-needed new projects on the airport property. Secondarily, the initial cost of the galvanizing was less than that of the proposed two-coat paint system. Additionally, the pleasing aesthetic appearance of the zinc patina and its uniformity over many years was an important factor. There would be no unsightly paint fading, cracking or chipping on this innovative design. Finally, and critical to the entire team of owner, architect, designer and construction contractor, was the certainty that the factory-controlled galvanizing process would pose no schedule delay due to weather.

American Galvanizers Association
6881 South Holly Circle
Suite 108
Englewood, CO 80112
Phone (720) 554-0900
Fax (720) 554-0909
www.galvanizeit.org
aga@galvanizeit.org

ASK

Dr. Galv

ZINC-COATED FASTENERS

What do I need to know about specifying fasteners used with hot-dip galvanized structural steel?

The first thing to know is that selecting hot-dip galvanized fasteners is absolutely the right choice. Had you chosen to use a fastener protected from corrosion by a plated zinc coating or paint, structural failure of the connection would very likely occur long before the galvanized beam, girder or pole would exhibit corrosion.

Because hot-dip galvanizing applies a consistent thickness of zinc coating on 100% of the fastener surface to a thickness of 1.7 to 3.4 mils (43 to 86 microns), depending on diameter, it provides cathodic and barrier corrosion protection for 2 to 4 times longer than zinc-plated fasteners, which have a typical zinc coating thickness of just 1 mil (25 microns). Thus, if you see zinc-protected fasteners at the base of a pole or as a girder connection and they show signs of significant base steel rusting after just 5 to 7 years, they were likely zinc-plated. That is cause for concern. (This condition should not be confused with ferrous-oxide staining that sometimes occurs on hot-dip galvanized steel. If the pure zinc outer layer of the zinc coating has been consumed over time [exposing the zinc-iron intermetalic layers of the galvanized coating] or if the galvanized coating was initially 100% zinc-iron intermetalic, slight brown staining may occur. This is only an aesthetic condition and does not degrade the long-term performance of the galvanized coating.)

Painting fasteners provides barrier protection solely, only as long as the film is intact, and does not provide consistent coating thickness. Painted fasteners are often damaged during tightening and require touch-up under field conditions (not necessarily controlled climactic conditions) that may yield poor coating protection results. Painting over galvanized fasteners is common in order to take advantage of the wonderful corrosion protection delivered by the galvanizing and the color delivered by the paint. Hot-dip galvanized fasteners have a coating bond strength in the range of 3600 psi (24.82 MPa) and a coating hardness (within the alloy layers) that is almost twice as hard as the base steel itself. Thus, the galvanized coating is not damaged during tightening.

The factory-controlled process of hot-dip galvanizing fasteners is independent of temperature and humidity conditions. In fact, galvanized fasteners are largely independent of weather also, performing well in continuous exposure conditions in the arctic and to the extreme of 392 F (200 C).

The metallurgical reaction between the zinc and steel is such that even edges and corners have the same zinc thickness as the flat surfaces. This translates into consistent corrosion protection over the entire surface of the fastener. It should be noted that although hot-dip galvanized fasteners deliver the best, most economical protection from corrosion, they do not generally have as thick a zinc coating as the beams, girders or poles to which they are connected. Thus, they may need slight touchup at some time in the future, usually 20 to 40 years after erection (using one of the three methods specified in ASTM A 780 *Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings*), prior to any maintenance requirement for the structural steel.