

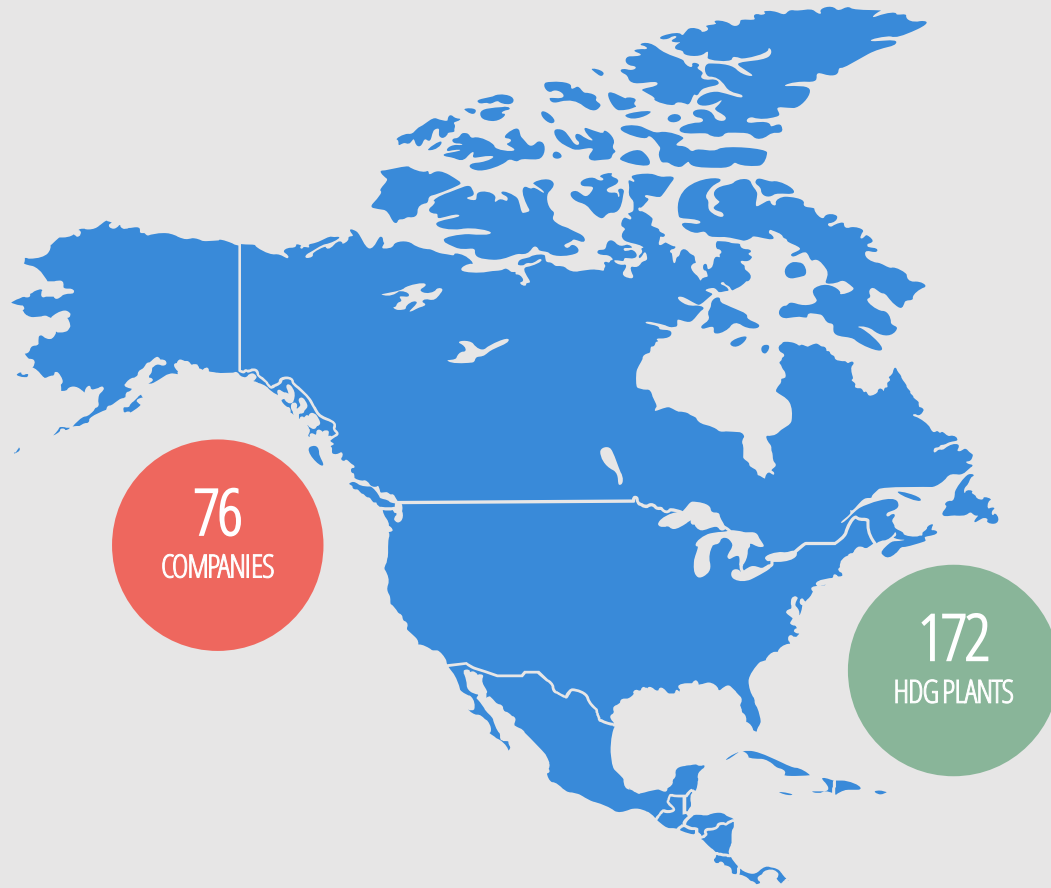
TOOLS AND RESOURCES TO DESIGNING COST-EFFECTIVE STEEL BRIDGES

STEEL BRIDGES IN ACTION: SUMMER WEBINAR SERIES



About the American Galvanizers Association (AGA)

Non-profit trade organization established in 1933



Technical

The AGA provides technical support on the performance, design, inspection and specification of HDG steel

Marketing

The AGA provides its members with sales & marketing support and serves as the unified voice of the industry

Specifiers

The AGA is a free resource to North American specifiers and provides guidance on specifying HDG steel

galvanizeit.org

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AGA TOOLS & RESOURCES

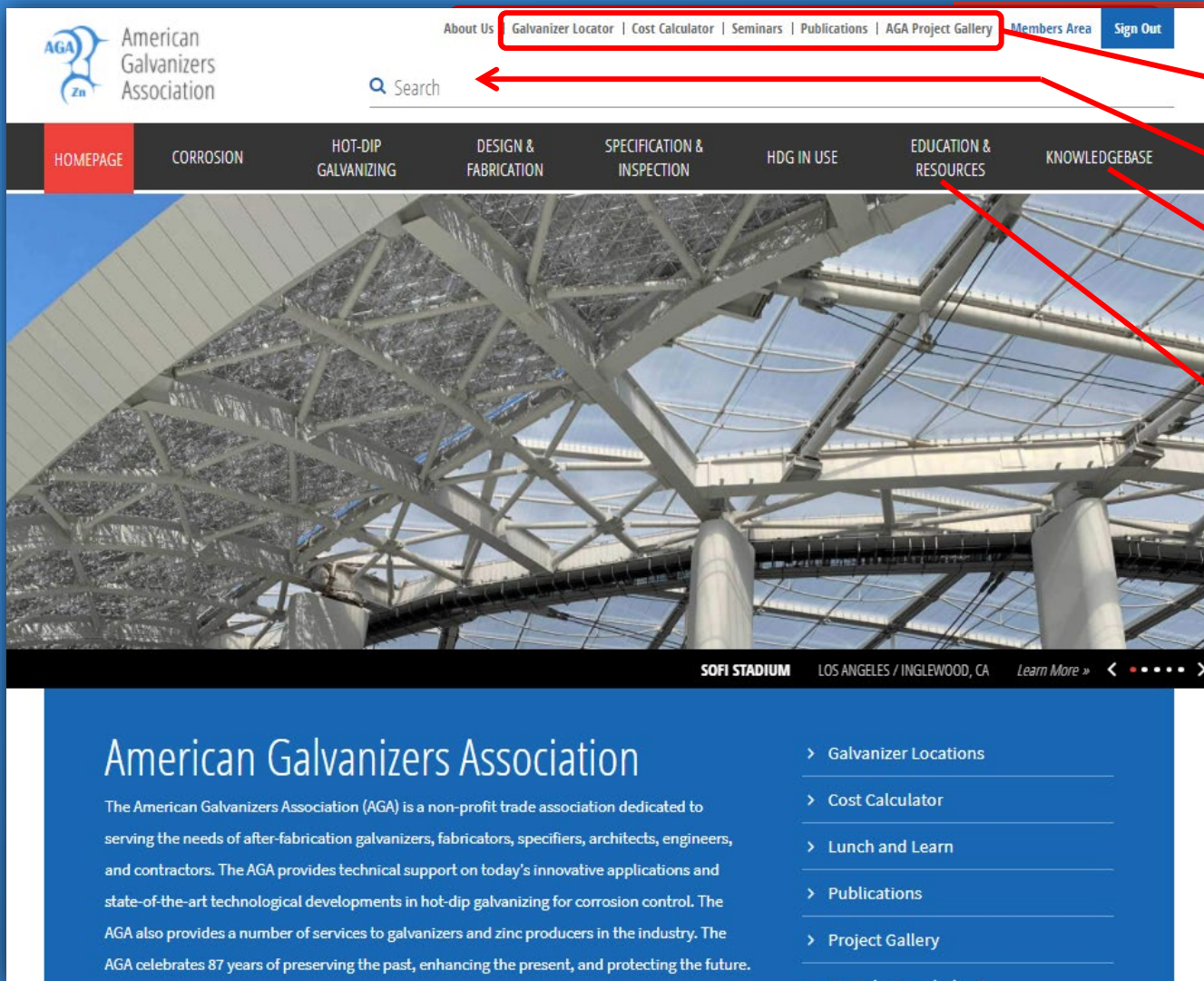
MIRA GUT BRIDGE

Cape Breton, Nova Scotia | 2023

536 tons – The entire superstructure is galvanized. The asphalt on the bridge surface is the only non HDG.



Website - Galvanizeit.org



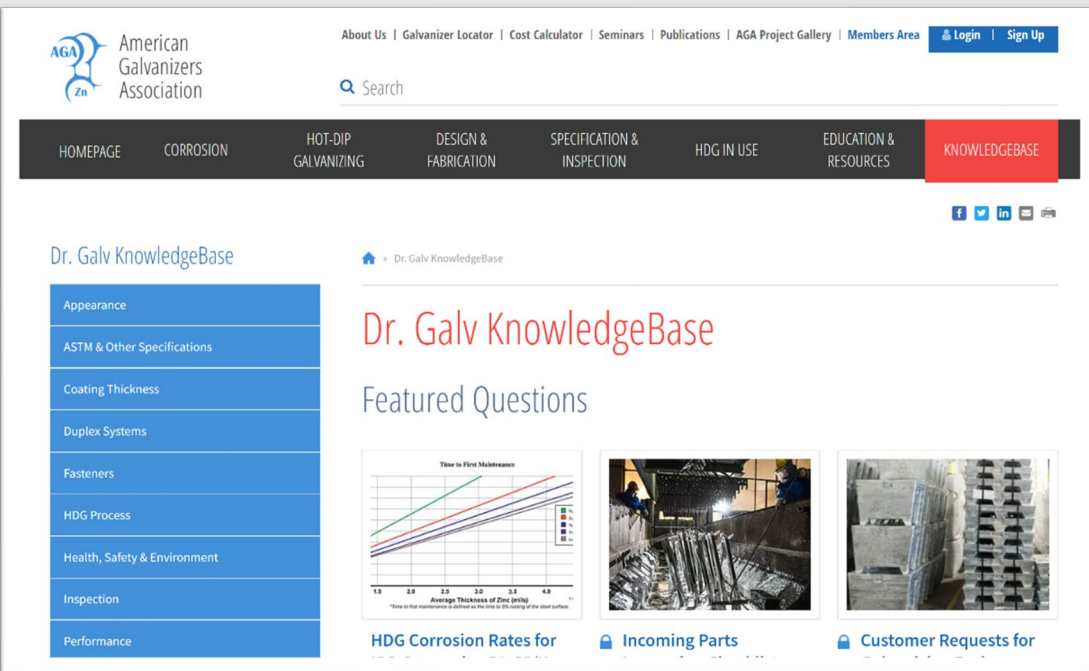
Tools & AGA Resources

Robust Search Function

Knowledgebase

Education & Resources

Dr. Galv™ Knowledgebase



- More than 400 short form Q&A articles
 - Organized by category
 - Visible using search function
 - Some are member protected
 - HDG Process
 - Environmental Health & Safety
- Designed to answer specific FAQs about anything galvanizing
- Technical expertise tailored to galvanizers



Knowledgebase Design & Fabrication



Design & Fabrication

Design Considerations

- Architecturally Exposed Structural Steel (AESS)
- Bend Diameters
- Cold Worked Steels
- Dissimilar Steel Chemistries
- Dissimilar Metal Corrosion with Zinc
- Distortion & Warping
- Bolts, Nails & Fasteners
- Part Identification
- Masking
- Material Handling
- Moving Parts
- Overlapped Surfaces
- Steel Residues
- Steel Selection
- Steel Size Limits
- Steel Surfaces

Design Considerations

Corrosion protection begins at the drawing board, and regardless of what protection system is specified, it must be factored into the products design. Similarly, all [corrosion protection systems](#) require certain design details and proper planning to ensure the highest quality coating. For hot-dip galvanizing, a total immersion process in molten zinc, the design engineer will want to ensure all pieces are fabricated suitably for the process. Most design principles necessary for success throughout the galvanizing process are easily and readily followed, and in most cases, ensure maximum corrosion protection. Incorporating these design practices along with those listed in [ASTM A315 Practice for Providing High Quality Zinc Coatings \(Hot-Dip\)](#), will not only produce optimum quality galvanized coatings, but also help reduce costs, improve turnaround times, and ensure the safety of galvanizing personnel.

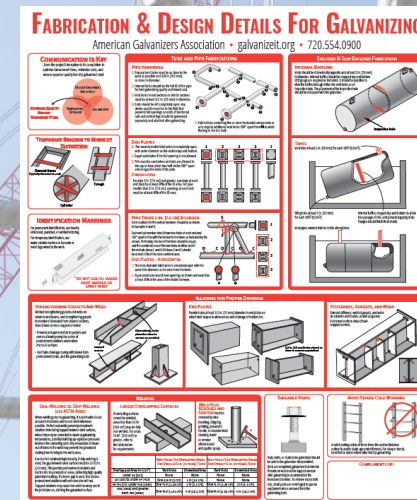
Select a topic from the alphabetical list below to view detailed information on each subject:

- Architecturally Exposed Structural Steel (AESS)
- Bend Diameters
- Cold Worked Steels
- Dissimilar Steel Chemistries
- Dissimilar Metals in Contact
- Distortion & Warping
- Fasteners, Bolts & Nails
- Hole Sizes

Design Considerations



Design Guide



Design Poster

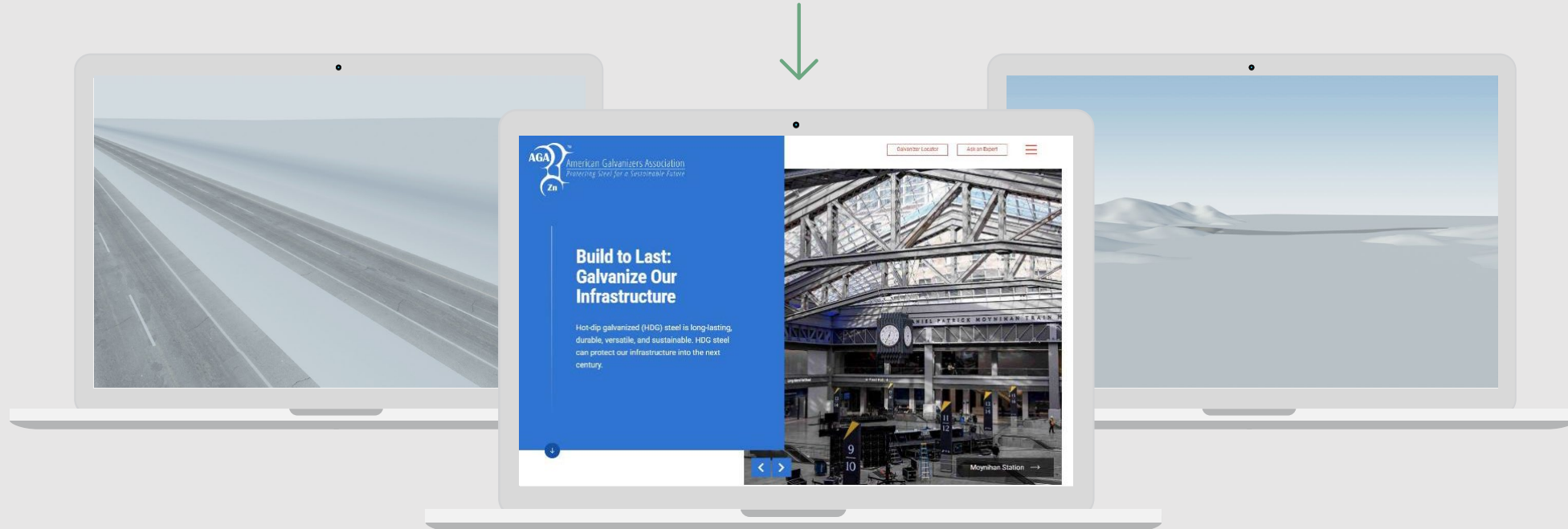


HDG Markets & Products Website

<https://markets.galvanizeit.org>

- Website Highlighting HDG Projects & Technical Info
- Organized by Market/Product Type & State/Provinces
- Animations Highlight the Various Uses of HDG Steel

 Visit Website

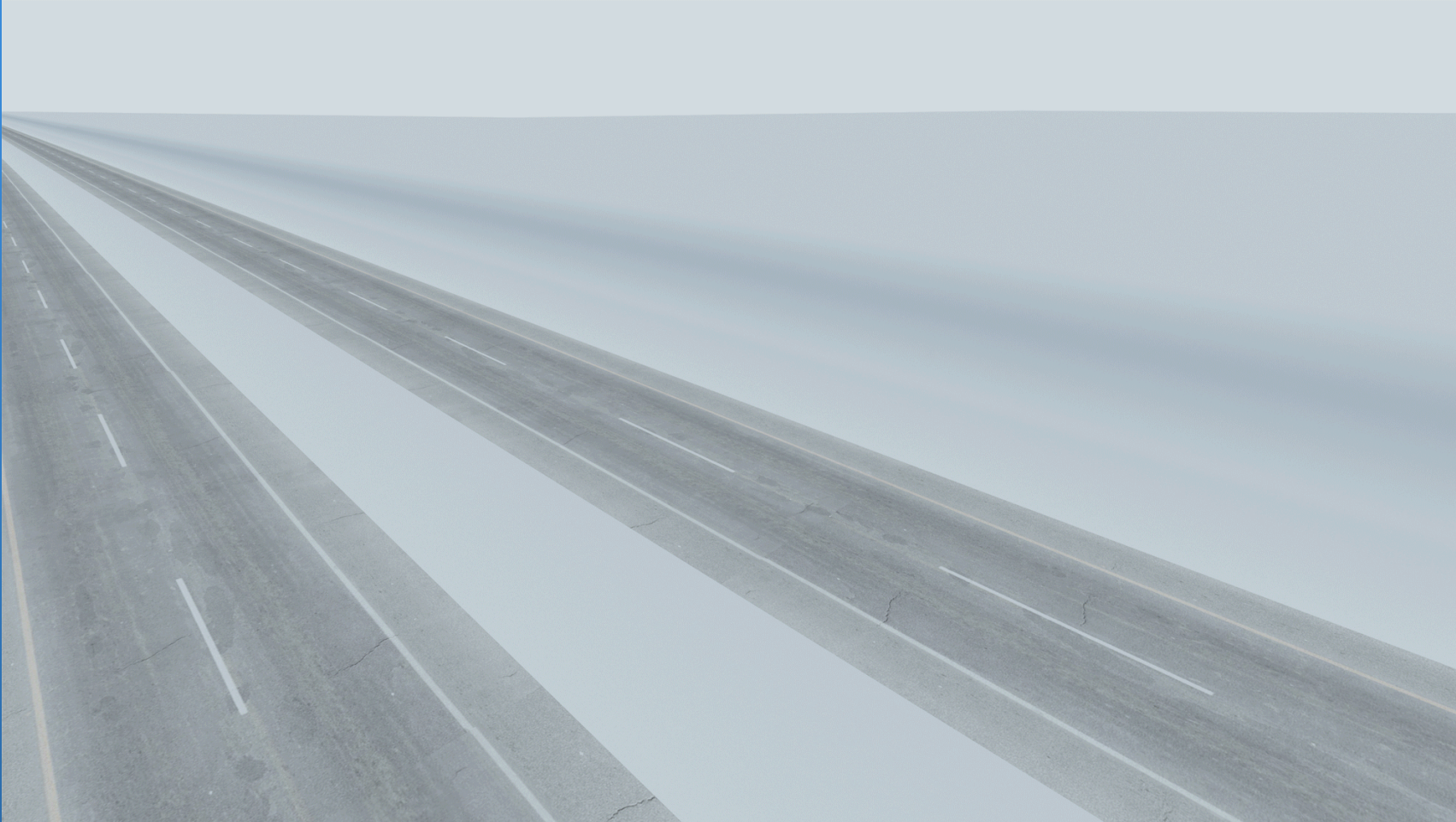


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HDG Components in Bridges & Highways

markets.galvanizeit.org

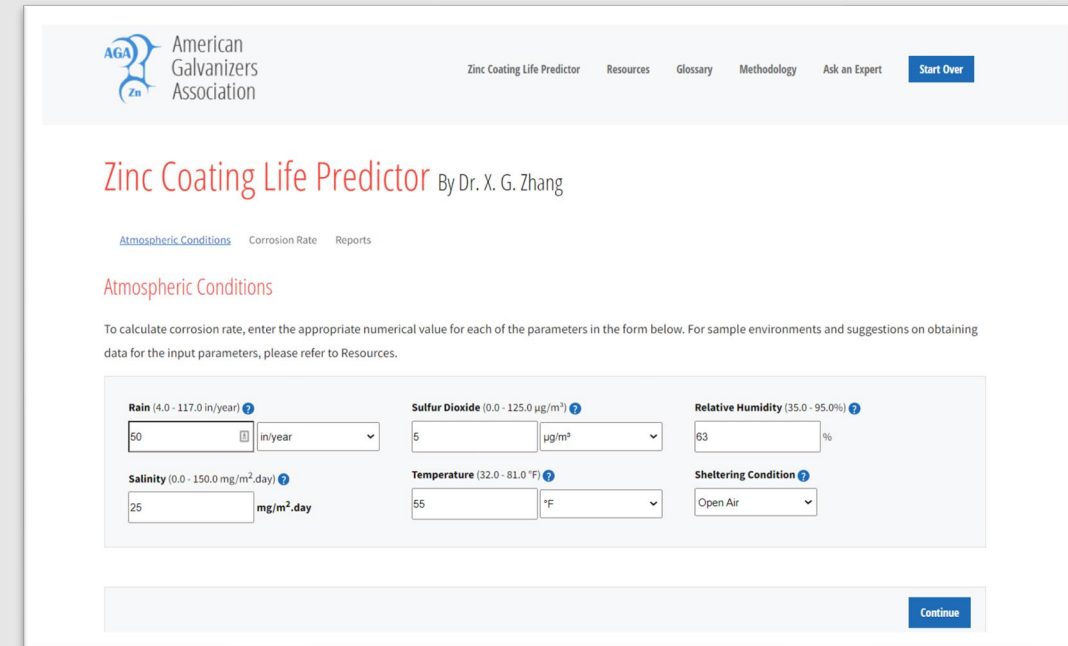


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Zinc Coating Life Predictor

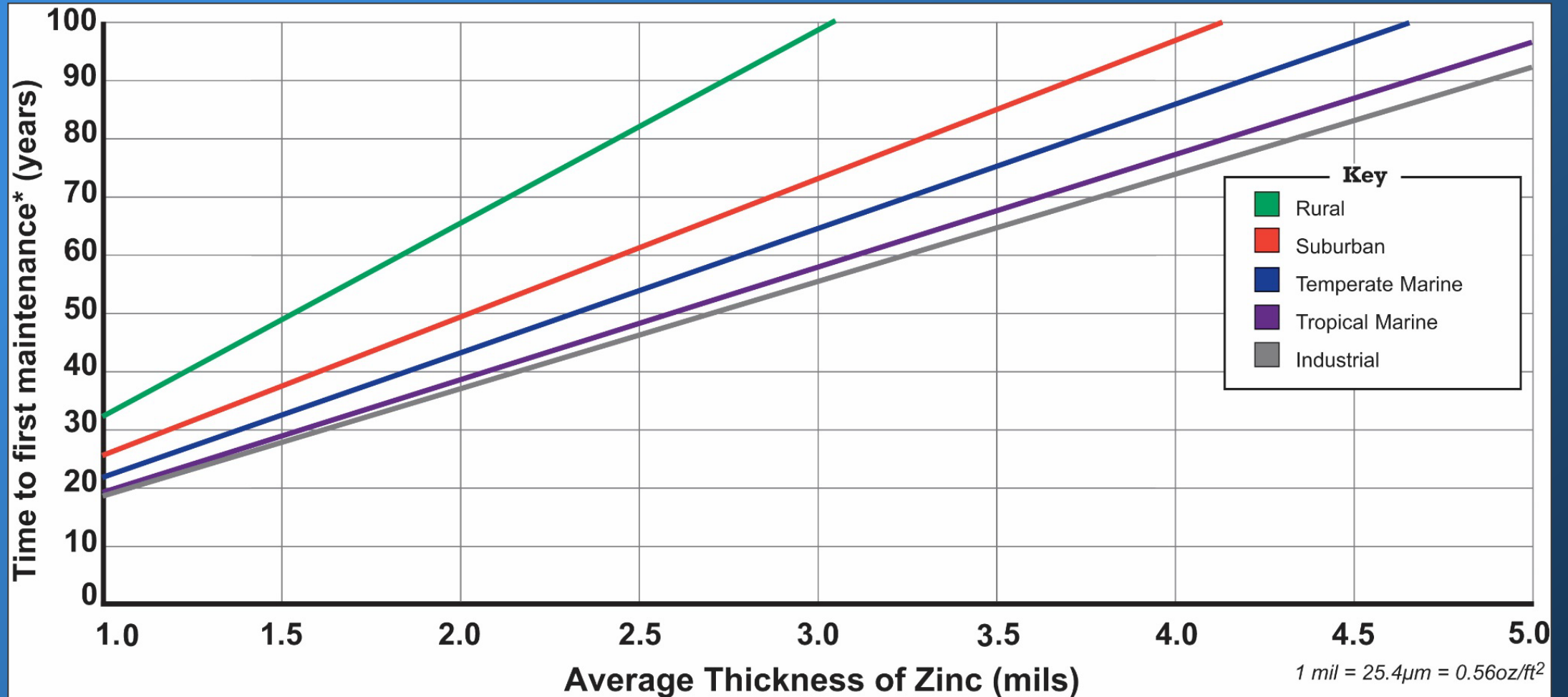
- Estimate the corrosion rate of zinc (galvanized) in various environments
 - Statistical Methods
 - Neural Network Technology
 - Extensive Worldwide Corrosion Database
- Users Guide w/ Links to Collect Local Data
 - <https://galvanizeit.org/knowledgebase/article/the-zinc-coating-life-predictor>
- Used to develop our Time-to-First Maintenance Chart
- **ZCLP.galvanizeit.org**



The screenshot shows the 'Zinc Coating Life Predictor' web application. The header includes the AGA logo and navigation links: 'Zinc Coating Life Predictor', 'Resources', 'Glossary', 'Methodology', 'Ask an Expert', and a 'Start Over' button. The main title is 'Zinc Coating Life Predictor By Dr. X. G. Zhang'. Below this, there are tabs for 'Atmospheric Conditions', 'Corrosion Rate', and 'Reports'. The 'Atmospheric Conditions' tab is active, showing a form with six input fields: Rain (4.0 - 117.0 in/year), Sulfur Dioxide (0.0 - 125.0 µg/m³), Relative Humidity (35.0 - 95.0%), Salinity (0.0 - 150.0 mg/m³.day), Temperature (32.0 - 81.0 °F), and Sheltering Condition. The form is currently empty, and a 'Continue' button is at the bottom right.



Time to First Maintenance Chart



**Time to first maintenance is defined as the time to 5% rusting of the steel surface.*

Soil Charts

Evaluate Chloride Concentration

> 20 PPM use Charts 1 & 2

- Evaluate Moisture Content
- Evaluate pH

< 20 PPM use charts 3 & 4

- Evaluate pH
- Evaluate Moisture Content

*NOTE: Service life is defined as the time to necessary part replacement (total zinc consumption + 25%)



Soil Chart
(PDF)

High Chlorides >20 PPM

CHART 1

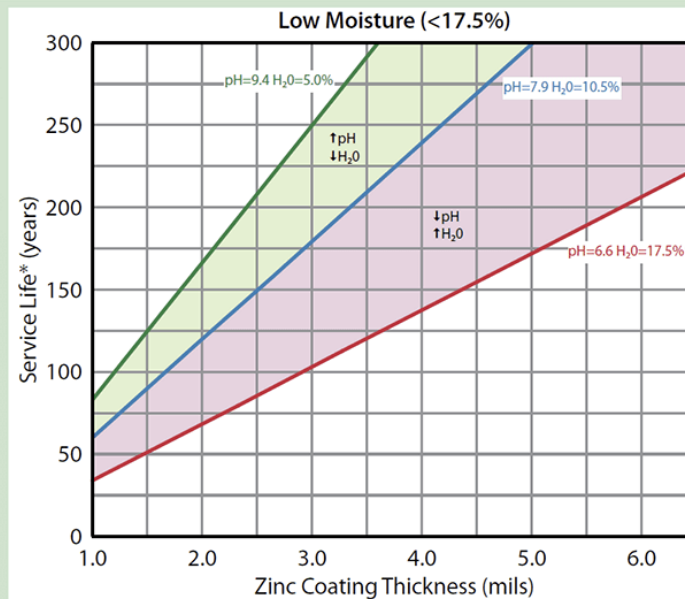
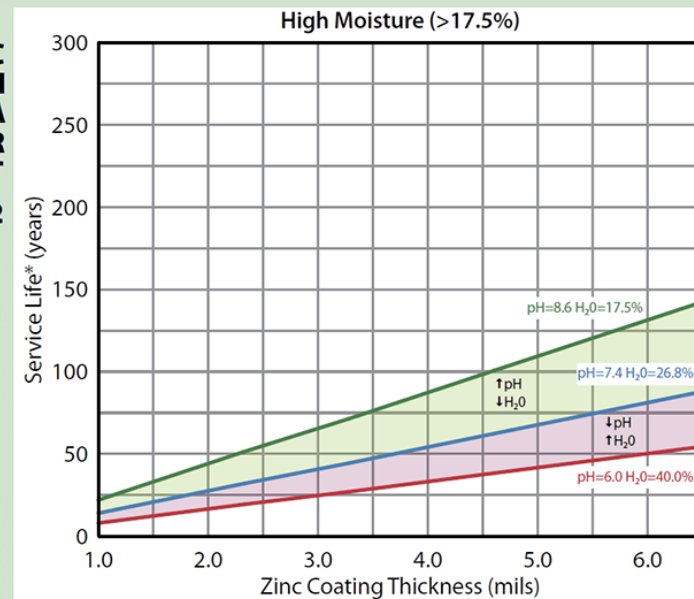


CHART 2



Low Chlorides <20 PPM

CHART 3

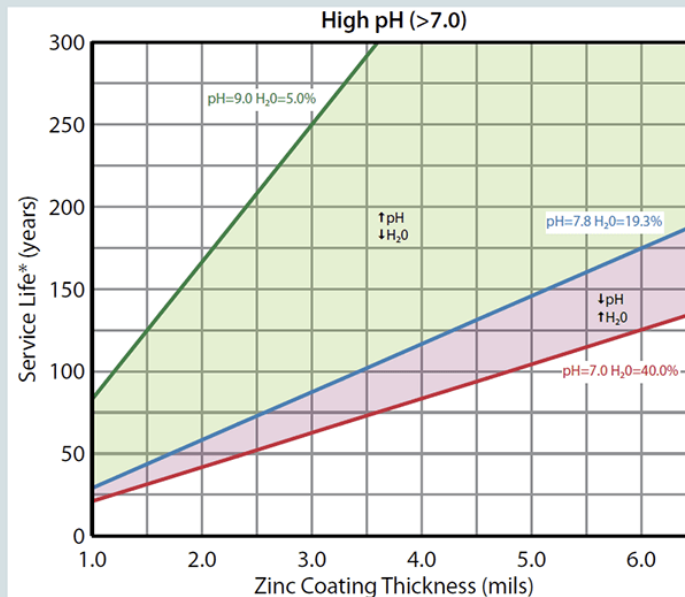
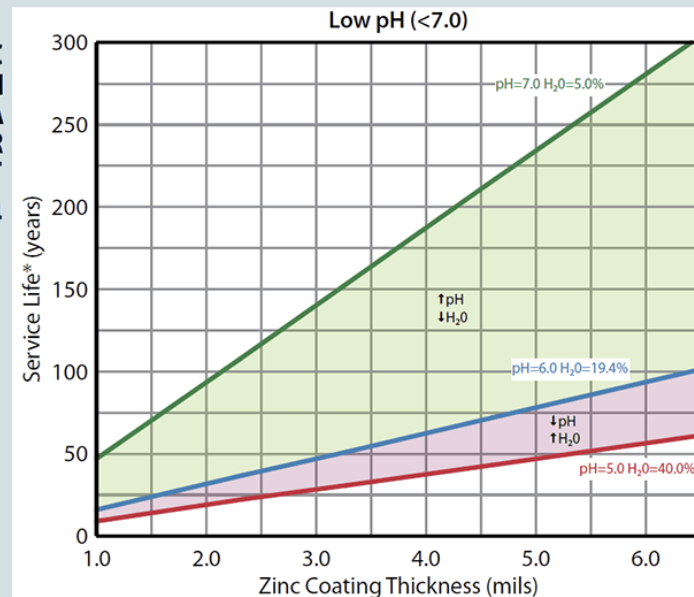


CHART 4



* Service life is defined as the time to necessary part replacement or underground maintenance.

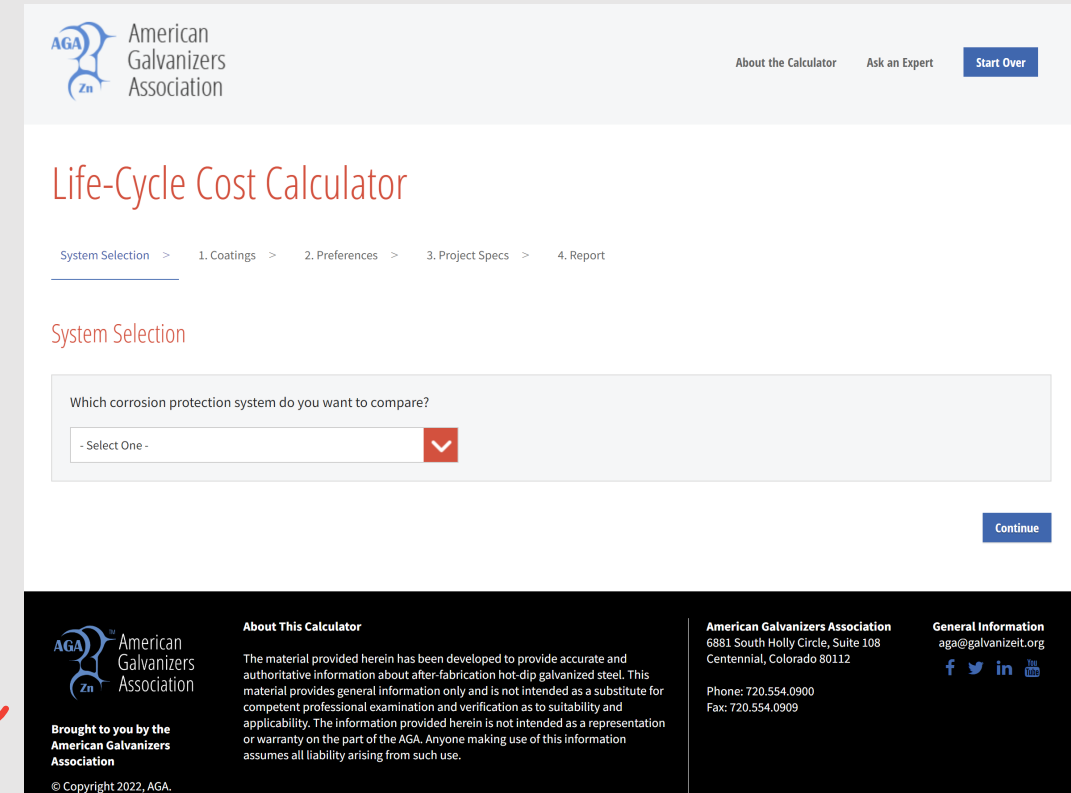

1 mil = 25.4 μ m = 0.56 oz/ft²

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Life-Cycle Cost Calculator

- Life-Cycle Cost Savings
 - Total cost throughout project life
 - Includes maintenance costs and time value of money (interest/inflation)
 - Often HDG initial cost IS life-cycle cost
- Life-Cycle Cost Calculator to ASTM A1068



The screenshot shows the 'Life-Cycle Cost Calculator' interface from the American Galvanizers Association. The header includes the AGA logo and navigation links: 'About the Calculator', 'Ask an Expert', and a 'Start Over' button. The main title 'Life-Cycle Cost Calculator' is in red. Below it is a progress bar with steps: 'System Selection' (active), '1. Coatings', '2. Preferences', '3. Project Specs', and '4. Report'. The 'System Selection' section asks 'Which corrosion protection system do you want to compare?' and features a dropdown menu with '- Select One -' and a red arrow button. A 'Continue' button is at the bottom right. The footer contains the AGA logo, a disclaimer about the calculator's purpose, contact information for the American Galvanizers Association (6881 South Holly Circle, Suite 108, Centennial, Colorado 80112; Phone: 720.554.0900; Fax: 720.554.0909), and general information (aga@galvanizeit.org) with social media icons.

LCCC: Inputs

PROJECT SIZE

Enter amount of steel to be coated.

☐ ft² ☐ tons

EXPECTED LIFE-SPAN

Amount of time before this structure is no longer maintained or in use.

Years

STRUCTURE TYPE

Specify the size and/or complexity of the structure.

- Select One -

▼

MEMBER TYPE

Select the project's structural makeup.

☐ Typical mix size/shapes
250 ft² / ton

☐ Large Structural
100 ft² / ton

☐ Medium Structural
200 ft² / ton

☐ Light Structural
400 ft² / ton

☐ Light Trusses
500 ft² / ton

SERVICE LIFE ENVIRONMENT

Select the environment that represents your project's location.

☐ Rural
Mild/Low Corrosion (C2)

☐ Industrial
Moderate/Medium Corrosion (C3)

☐ Heavy Industrial
Severe/Very High Atmospheric Corrosion (C5-I)

☐ Seacoast
Very high Atmospheric Corrosion (C5-M)

LCCC: Reports

Life-Cycle Cost Calculator

System Selection > 1. Coatings > 2. Preferences > 3. Project Specs > 4. Report

Cost-Comparison Report ⓘ

Review and customize before printing

Cost-Comparison Report

The cost of galvanizing vs. a paint system

Cost Comparison

HDG vs. IOZ/Epoxy/Polyurethane

	HDG	Paint System
Initial Cost		
Per ft ²	\$2.16	\$4.98
Total	\$108,000.00	\$249,050.00
Life-Cycle Cost		
Per ft ²	\$2.16	\$31.39
Total	\$108,000.00	\$1,569,500.00
AEAC		
Per ft ²	\$0.07	\$1.08

For this project...
HDG Life-Cycle Cost Savings: 93%

DETAILED COST COMPARISON

HDG vs. IOZ/Epoxy/Polyurethane

Cost Of Galvanizing	Today's Cost	Net Future Value	Net Present Value
Original Galvanizing	\$2.16	\$2.16	\$2.16
Total Price / ft ²	\$2.16	\$2.16	\$2.16

Cost Of Paint System	Today's Cost	Net Future Value	Net Present Value
Original Painting	\$4.98	\$4.98	\$4.98
Touch-Up - Year 21	\$2.49	\$5.68	\$3.05
Maint. Repaint - Year 31	\$4.48	\$15.42	\$6.08
Full Repaint - Year 42	\$8.47	\$43.97	\$12.71
Touch-Up - Year 63	\$2.49	\$29.47	\$4.58
Total Price / ft ²	\$22.91	\$99.52	\$31.39

PRINT PREVIEW

CUSTOMIZE REPORT

Project Name

Subtitle

Your Company's Name

Address

City, State & Zip

Your Name

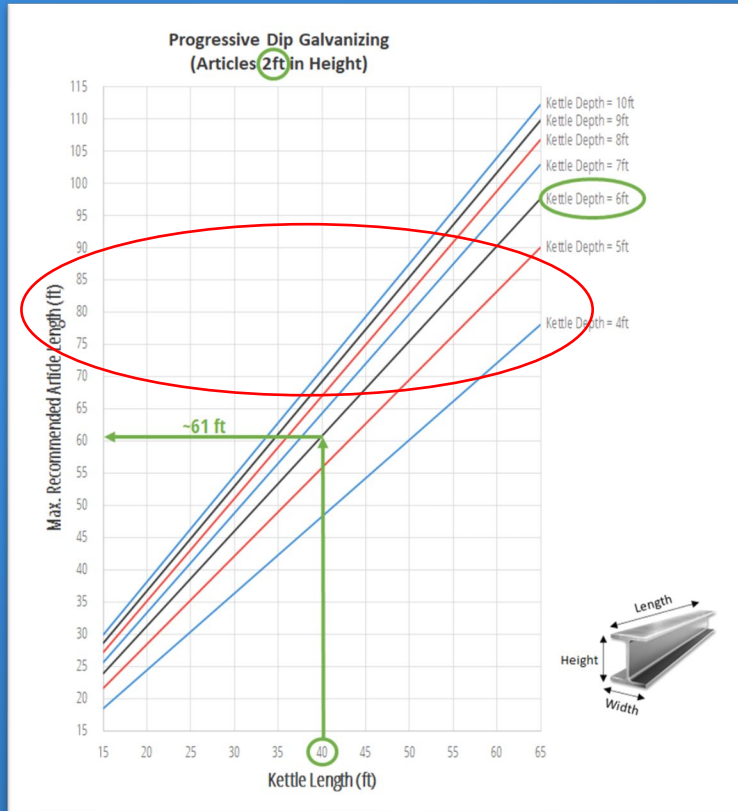
Title

Tel

Email

Update

AGA Resources for Progressive Dipping



Progressive Dip Charts

Search Results:

Address/Zip State/Province Company Name

Search Locations by Address/Zip

77584 100 miles SEARCH

This listing only shows the dimensions of the galvanizer's kettle (bath), and does not indicate the maximum material size that can be galvanized. Please contact the galvanizer for more information on capacity limits.

Galvanizers:

Filter by:

Length ☐ 0-24 ☐ 25-34 ☐ 35-44 ☐ 45-54 ☒ 55+
Width ☐ 0-4 ☐ 5-7 ☐ 8+
Depth ☐ 0-5 ☐ 6-7 ☐ 8-9 ☐ 10+

Valmont Coatings - United Galvanizing
6123 Cunningham Rd Phone: (713) 466-4161 Kettle(s) (L x W x D):
Houston, TX 77041 Website 61' x 7'3" x 7'3"
United States 42' x 5' x 6'
View Portfolio

AZZ Galvanizing - Houston West
9103 fairbanks, N. Houston Phone: (832) 467-3772 Kettle(s) (L x W x D):
Houston, TX 77064 Website 62' x 8' x 10'

Galvanizer Locator
(sort by Kettle Size)

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AGA American Galvanizers Association
Protecting Steel for a Sustainable Future

Progressive Dip Calculator

USER INPUTS

Enter Kettle Dimensions:

K (Kettle Depth)	72 inches
L (Kettle Length)	600 inches
W (Kettle Width)	60 inches

Enter Article Dimensions:

(S) Height	34 inches
Length	780 inches
Width	16 inches

Enter Properties of Zinc Height:

Dross Line Height	8 inches
Freeboard Height	4 inches

If unknown: use dross height = 8 in. and freeboard = 4 in.

Allowable Angles in the Bath:

θ minimum	6.1 °
θ maximum	6.3 °

Can This Article be Fully Galvanized? YES ✓

Article Orientation: I

Dip Method: Progressive Dip

F (Freeboard Height)
Gt (Length Galvanized on Top) = 245in
Gb (Length Galvanized on Bottom) = 562in
H (Zinc Height) = 60in
K (Kettle Depth) = 72in
L (Kettle Length) = 600in
D (Dross Line)
S (Article Height) = 34in
θ = 6.1°
Gt + Gb (Max. Progressive Dip Length) = 807.1in

Progressive Dip Calculator

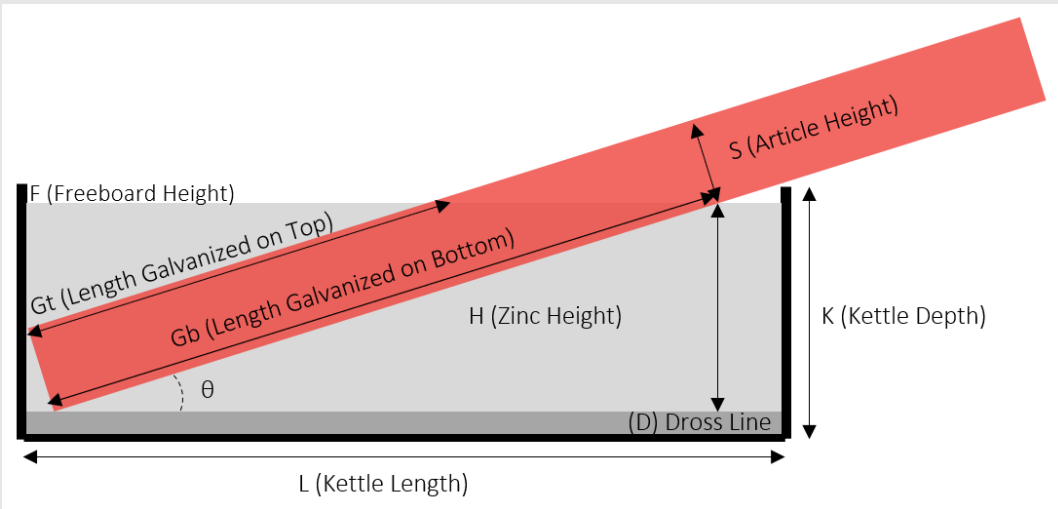
Progressive Dipping

→ Depends on:

- Kettle dimensions
- Part dimensions
- Material handling capabilities (layout, cranes)

→ Managing Expectations:

- Overlap line appearance and roughness
- Uneven heating
- Increased susceptibility to warpage



Inspection

- Steel inspected after galvanizing to verify conformance to specs
- Visual inspection with naked eye
- Coating thickness checked by magnetic thickness gauge
- Inspection of HDG Steel Products Guide
- [AGA Online Inspection Course](#)
- Download free Inspection App
 - galvanizeit.org/mobile



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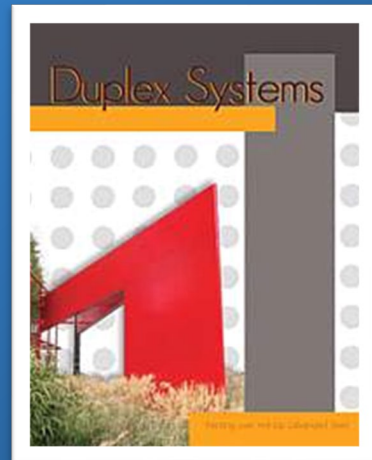
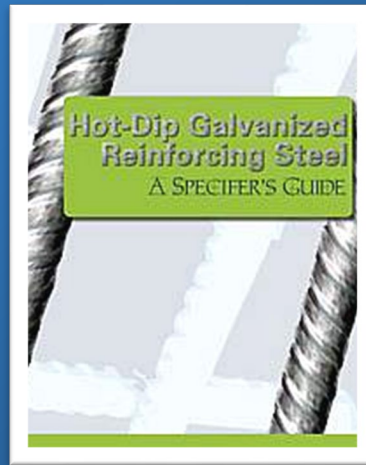
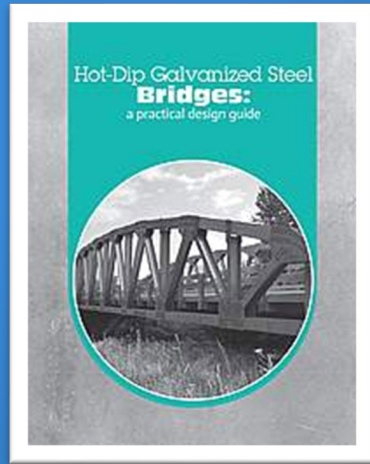


 Inspection of HDG Products Guide (PDF)



Publications

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- **Bridge Specific Publications**
- **Hot-Dip Galvanized Steel Bridges: A Practical Design Guide**
- **Hot-Dip Galvanized Reinforcing Steel: A Specifier's Guide**
- **Duplex Systems: Painting over HDG**
- **Inspection of Hot-Dip Galvanized Steel Products**
- **Hot-Dip Galvanizing for Sustainable Design**

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QUESTIONS?

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Protecting Steel for a Sustainable Future

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