

ALAZZ

GALVANIZING SERVICES

Bridge Preservation



AZZ Galvanizing Services

Kevin Irving

Marketing Manager Northern Ops

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815-693-4242

The Corrosion Problem



Tour of the City

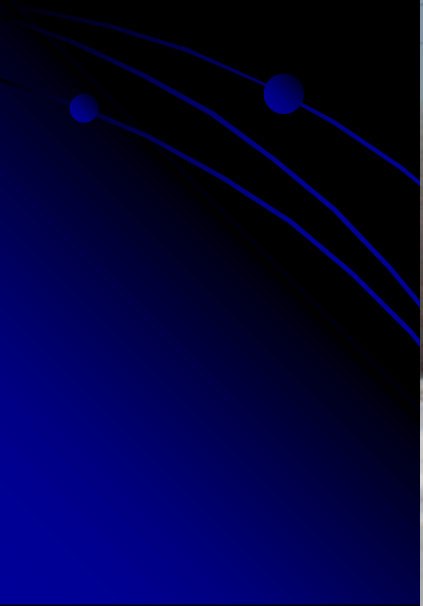


age to Canada 1/4
Clark Ave 1
nois Ave. 1 3/4









I-69 Bridge





6.20 6.10 7.60
8.90 7.70

7.60 8.00 5.70
5.50 7.40

$\bar{X}=6.82$

7.60 7.70 6.70
5.80 5.60

6.20 6.10 7.60
8.90 7.70

7.50 7.50 6.60
7.30 5.60

Beam 1

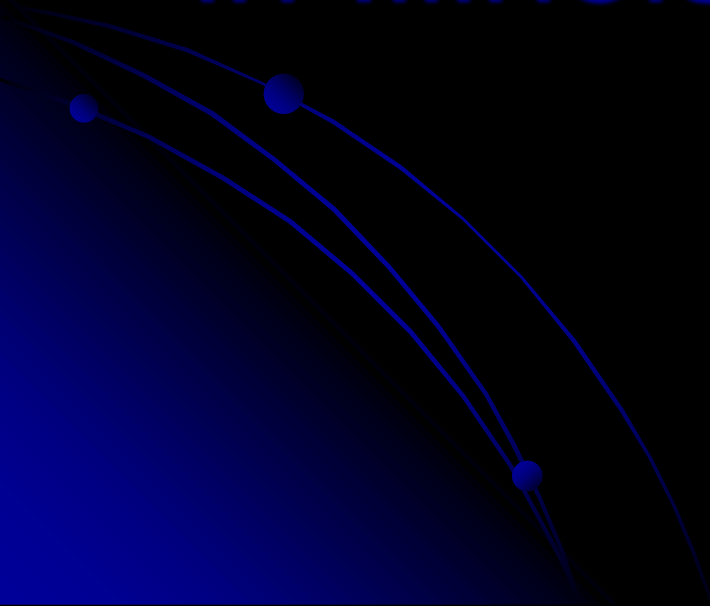
Ford County – 00N, 2350E



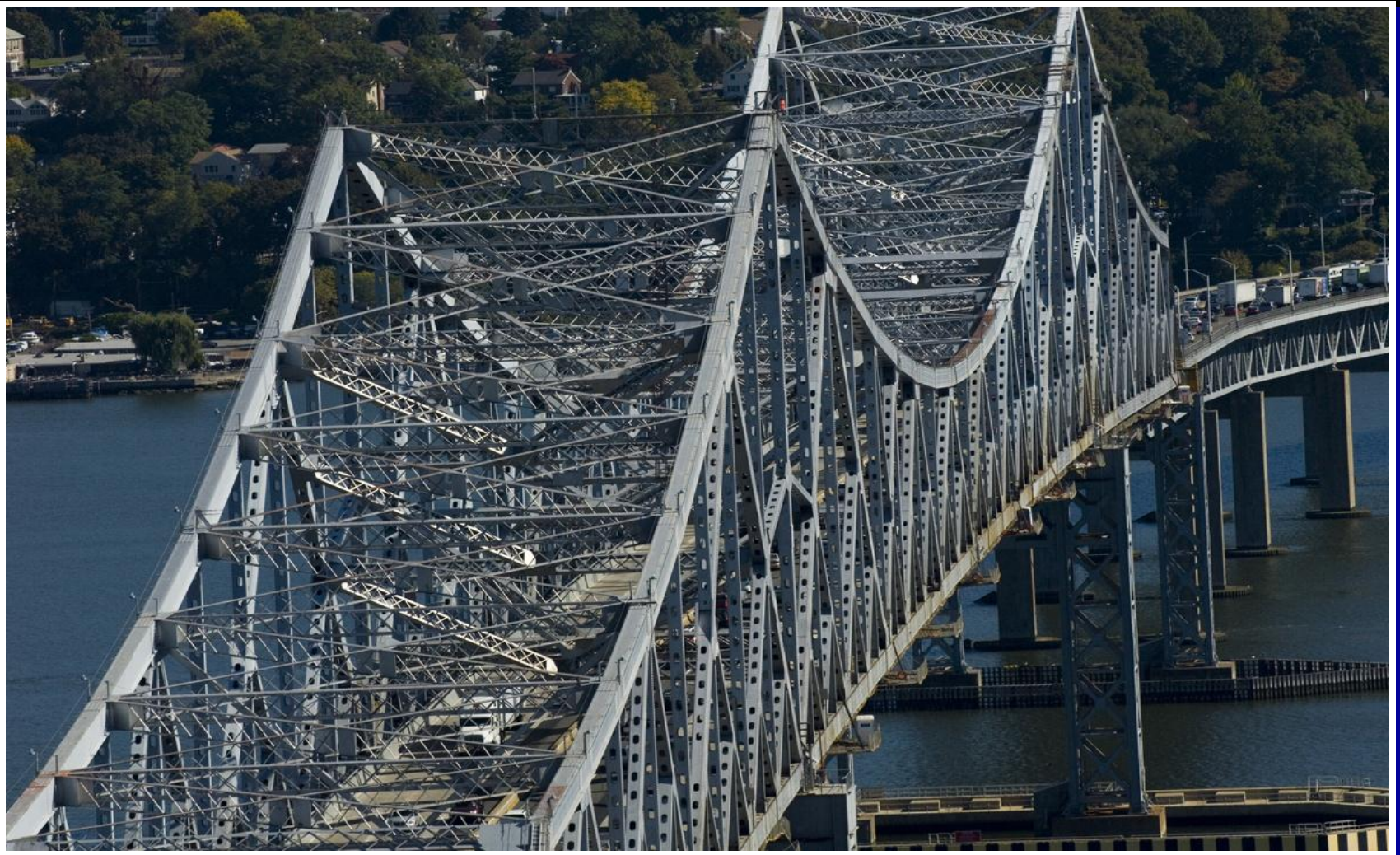


CTA , IL Toll Road, IDOT &
Counties

Over 50 Million Pounds of
Bridges were Galvanized
in Illinois in last 5 years.



Tappenzee Bridge



Tappenzee Bridge



Michigan/MI-102 Bridge Rail

Date Galvanized
2007



Components Galvanized
Guide rails

Environment
Urban

Location
Detroit, MI

Michigan / MI-102 Bridge Rail





Richland County Bridge





Knox County, OH - Before



Knox County, OH - After

Corrosion Problem – Case Study

The Williamsburg Bridge
built in 1903 in New York City



1991 inspection revealed severe corrosion
direct cost of repairs was \$750 million
indirect cost approximately \$8.2 billion

40% of Carbon Steel Goes to Replace Corroded Steel



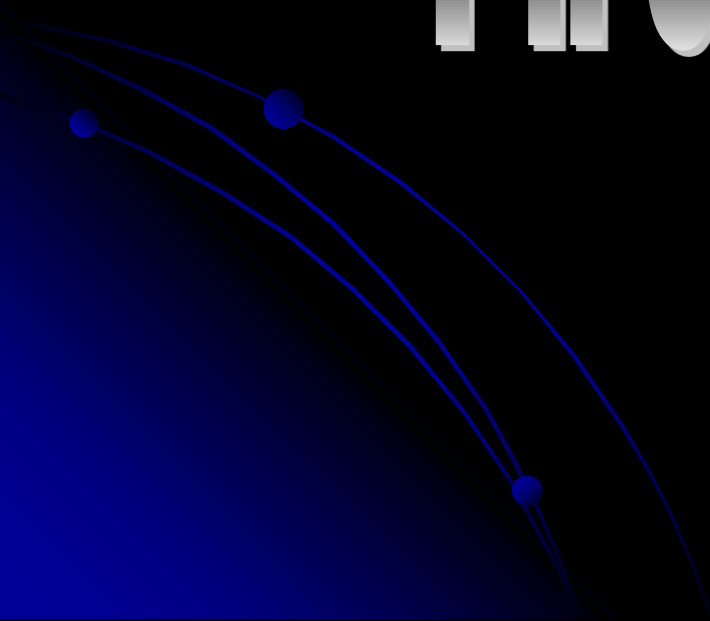
At a Cost of
\$350 Billion per Year



Equivalent of Building 562 Willis Towers (Sears) Every Year



The Solution



Long-Lasting Zinc Protection

- Barrier
 - Cathodic
 - Metallurgical Bond
- 



Barrier Protection

Cathodic Protection

Zinc



Galvanic Series of Metals

ZINC = ANODE

STEEL = CATHODE



This arrangement of metals determines what metal will be the anode and cathode when the two are put in a electrolytic cell (arrangement dependent on salt water as electrolyte).

Sacrificial Zinc Anodes



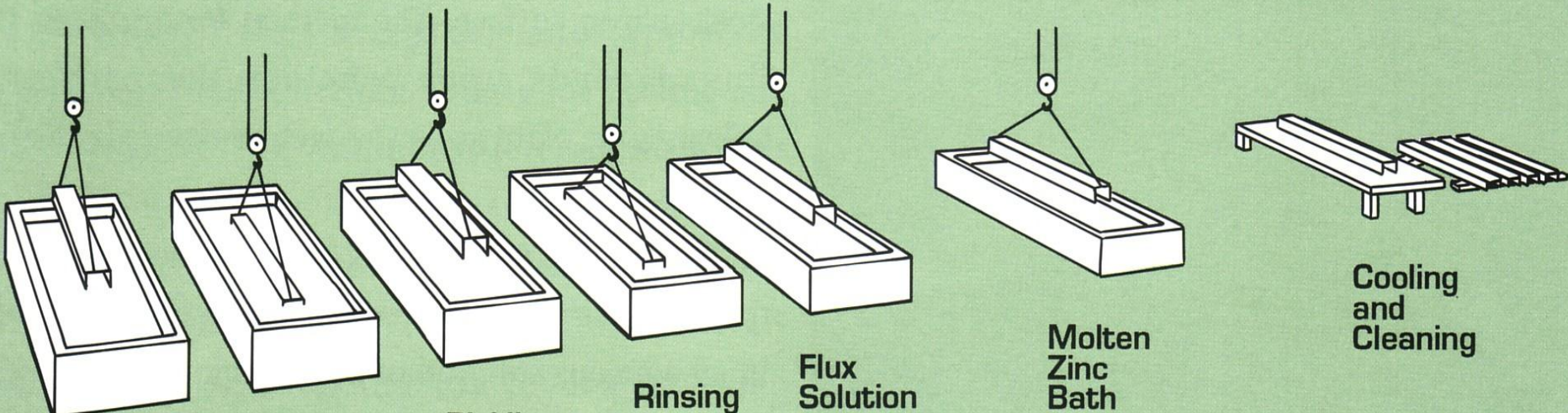
Galvanizing Process



Surface Preparation

Galvanizing

Inspection



Caustic Cleaning

Rinsing

Pickling

Rinsing

Flux Solution

Molten Zinc Bath

Cooling and Cleaning

Hot Dip (Dry) Galvanizing





HDG Process: Inspection



- Steel is inspected after galvanizing to verify conformance to specs
- Visual inspection to identify any surface defects
- Magnetic thickness gauge to check coating thickness

104224 284

10422x40

2858-911

Metallurgical Bond

Eta

100% Zinc

Zeta

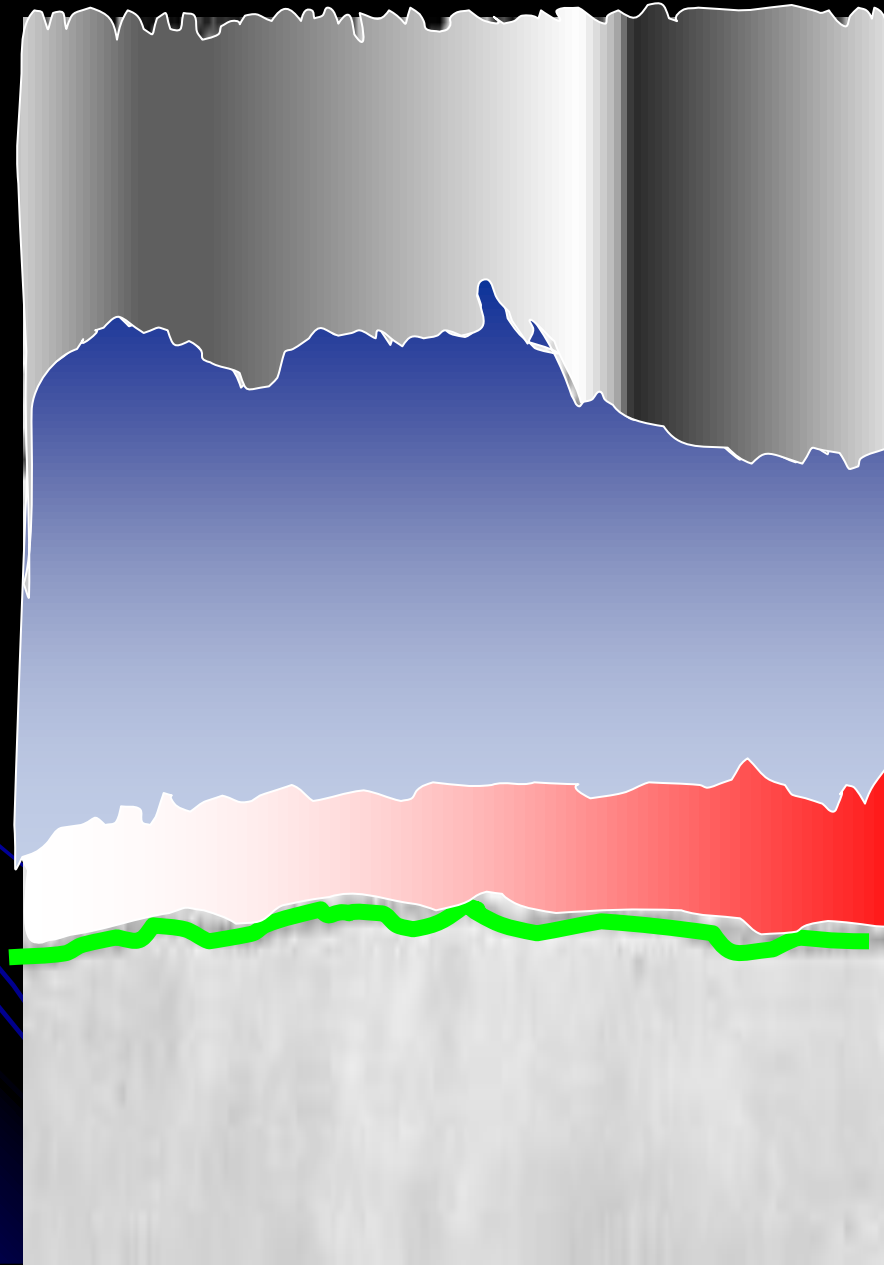
94% Zinc
6% Iron

Delta

90% Zinc
10% Iron

Gamma

75% Zinc
25% Iron



Abrasion Resistance

Eta

DPN = 70

Zeta

DPN = 180

Delta
Gamma
Steel

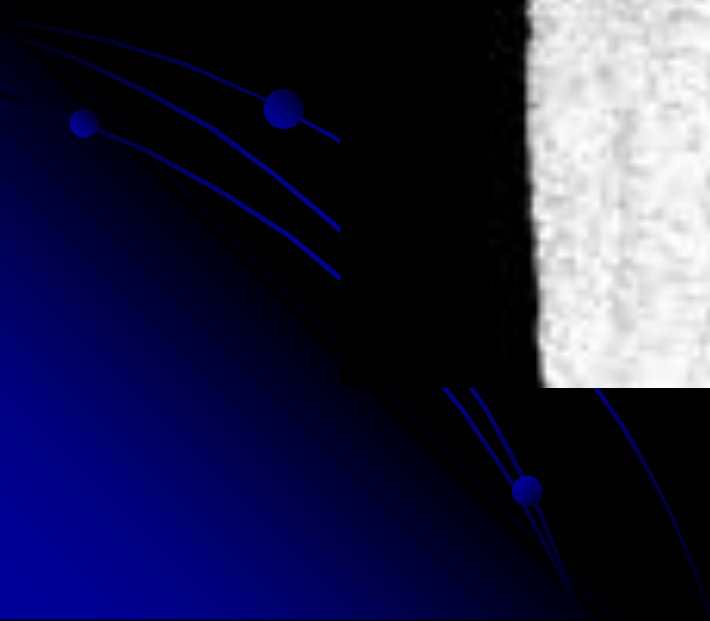
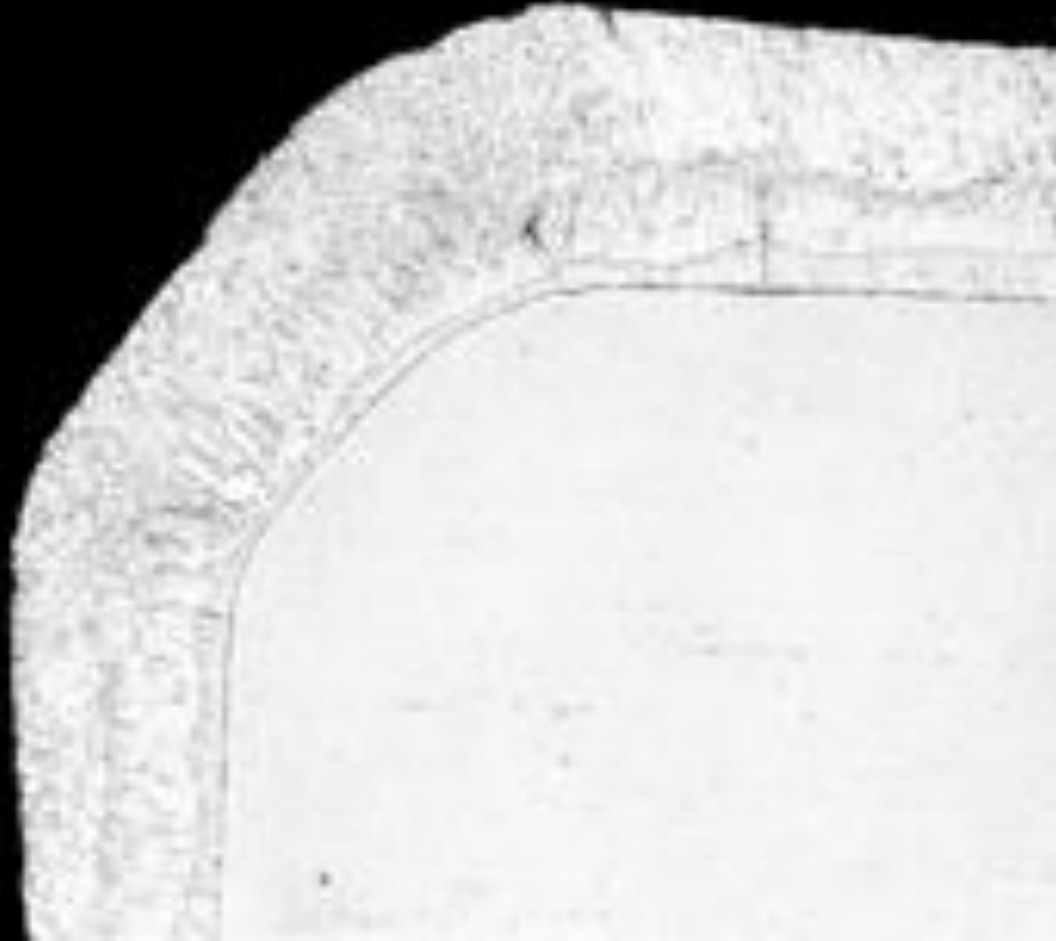
DPN: Diamond
Pyramid
Number

DPN = 245

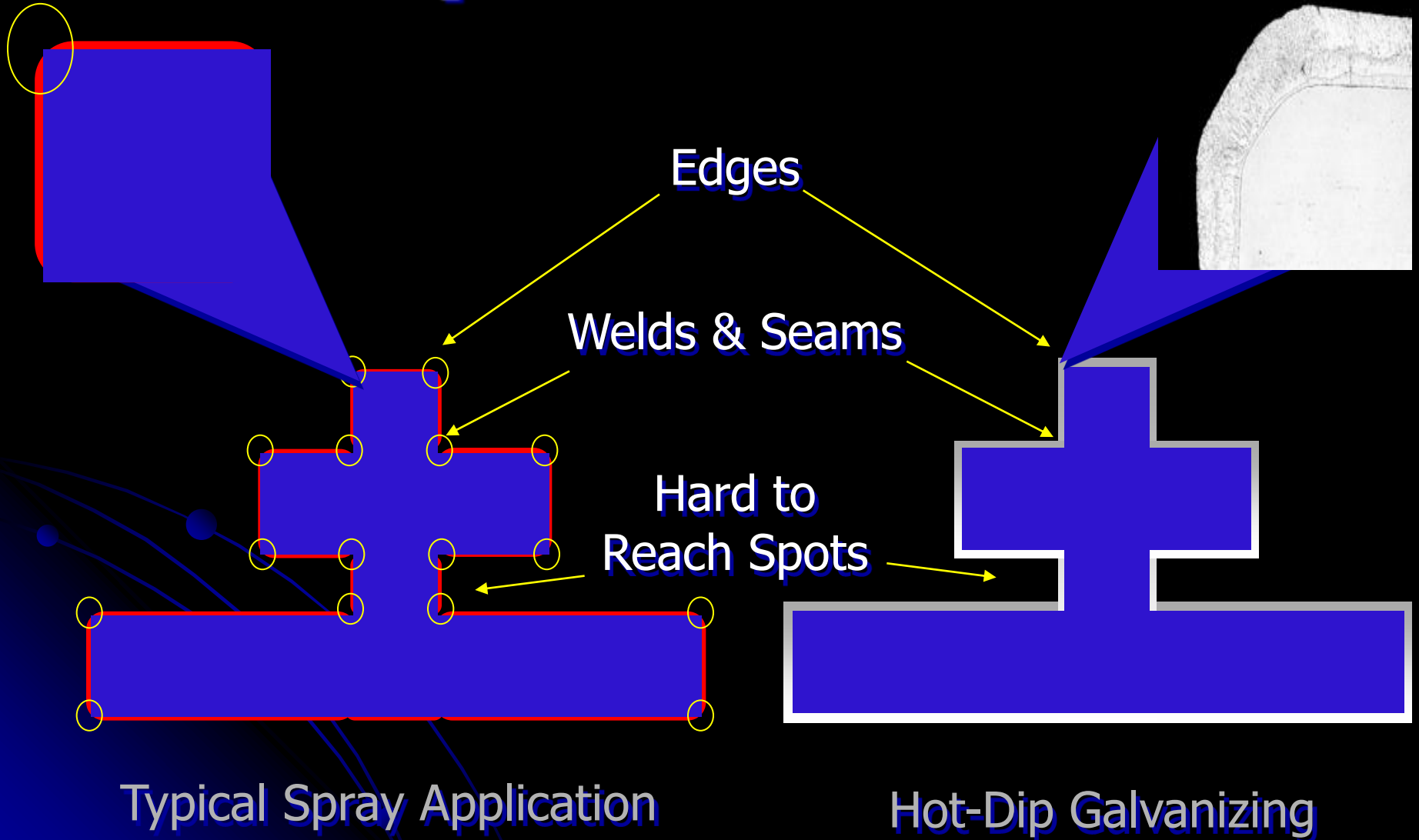
DPN = 250

DPN = 159

Edge Protection



Complete Protection





No Volatile Organic Compound's

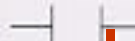
Other Zinc Coatings

Metallized
Hot-Dip
Galvanized

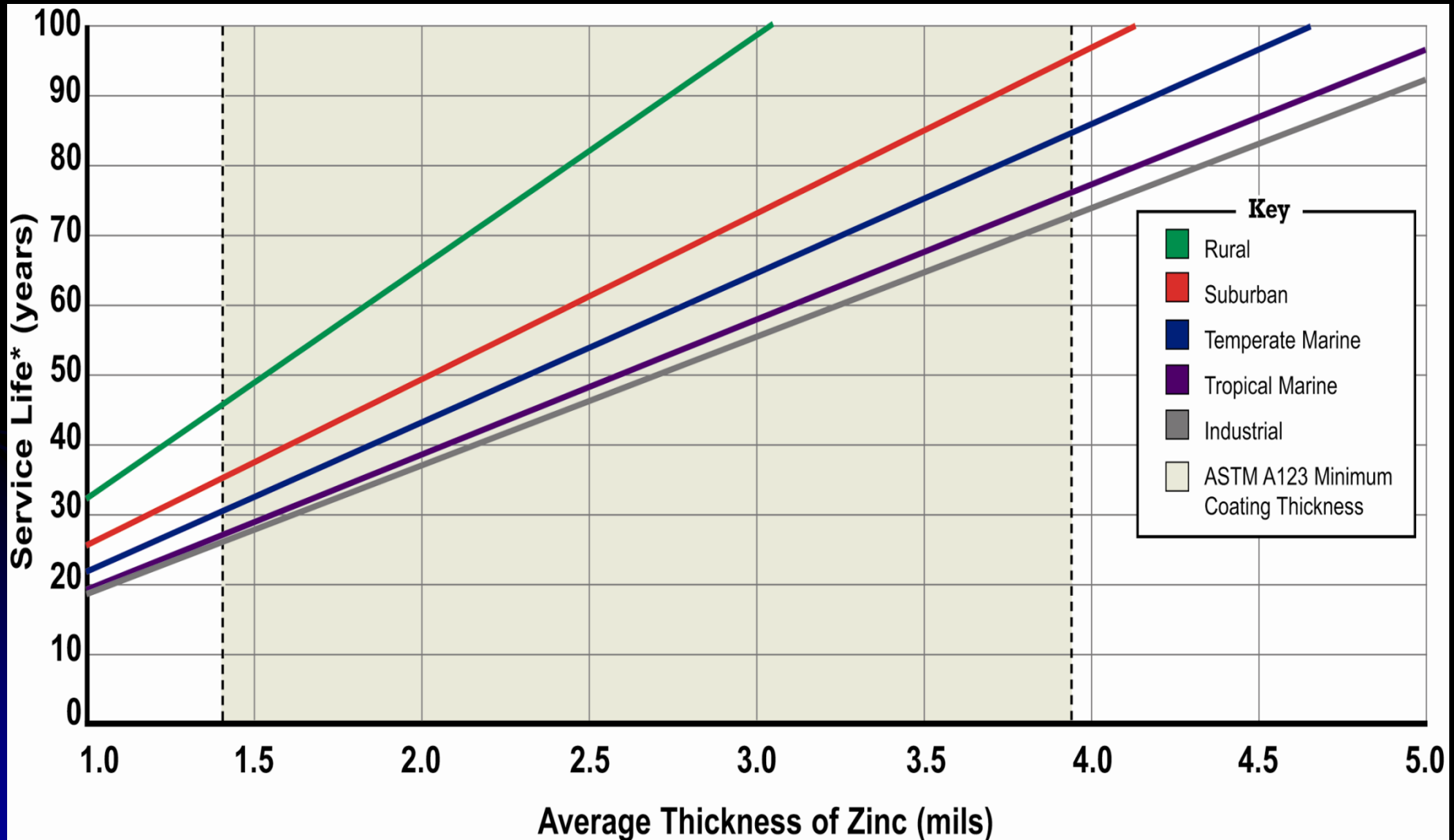


ized
Electroplated

1 mil

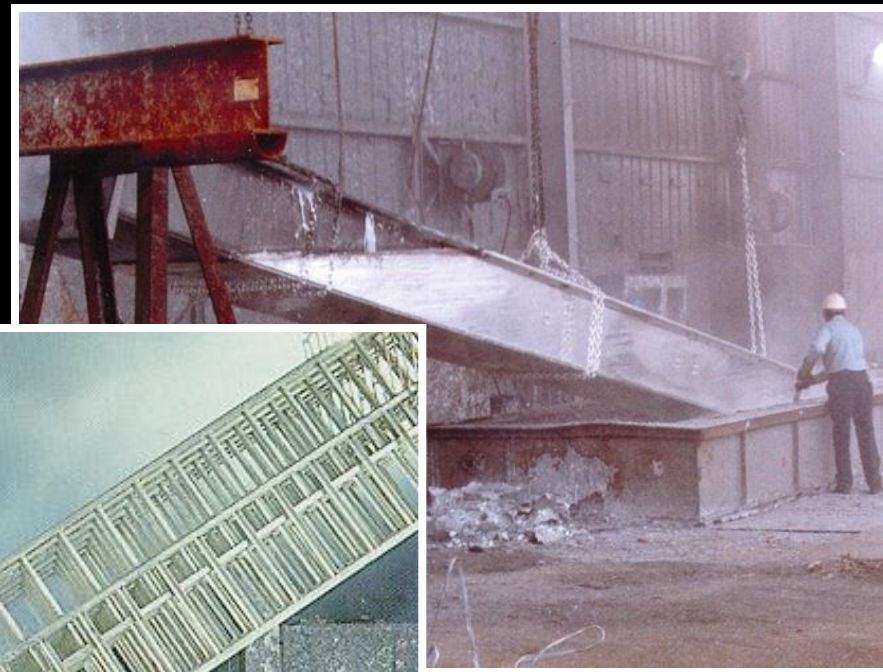


Estimated Service Life of HDG



*Service life is defined as the time to 5% rusting of the steel surface. 1 mil = 25.4 μ m = 0.56oz/ft²

Galvanizing Oversized Pieces





09.19.2006



26th Street & the Dan Ryan

ASTM A 767



**Zinc-coated Steel Bars
for Concrete Reinforcement**

YEOMANS



GALVANIZED STEEL REINFORCEMENT IN CONCRETE

GALVANIZED STEEL REINFORCEMENT IN CONCRETE



EDITED BY STEPHEN R. YEOMANS



HOT DIP GALVANIZED REINFORCING STEEL
A CONCRETE INVESTMENT



Zinc *Protects!*



www.galvanizedrebar.com

GALVANIZED REBAR resource center


Site search:

Friday 9th June, 2006

- Home
- What is Galvanized Rebar?
- Performance in Concrete
- Field Handling
- Cost/Economics
- Inspection
- Competitive Materials


Welcome to the Galvanized Rebar Resource Center!
This web site has been created by the International Zinc Association (IZA) to provide construction engineers and architects with relevant information on the properties and performance of hot dip galvanized reinforcing steel.

IZA's global mandate to support and develop zinc end uses is accomplished through regional partners located around the world. We encourage you to contact your regional representatives with any questions that you have on hot dip galvanized rebar or how to locate a local galvanizing company.



In The News...

- PennDOT approves use of galvanized reinforcing steel as an alternative to epoxy (FBE)
- FHWA Rebar Seminar Series goes to the Oregon DOT (February 1st)



Literature about Galvanized Rebar

Hot-Dip Galvanized Reinforcing Steel: A Concrete Investment
Overview of hot-dip galvanized rebar's world-wide performance in concrete, as well as design, specification, fabrication, and installation information.
[Download](#)

Galvanized Steel Reinforcement in Concrete
Internationally recognized authors with expertise in corrosion of reinforcement in concrete have contributed to a comprehensive new guide to the use of galvanized steel reinforcement in concrete.
[Order online from Elsevier](#)

Regional Focus

- North America**
Find organizations in North America that provide information on galvanized reinforcement.
- Europe**
Find organizations in Europe that provide information on galvanized reinforcement.
- Middle East**
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- Asia**
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ASTM A 780



Zinc-Based Alloys



Zinc Dust Paint



Metallizing

**Repair of Damaged & Uncoated
Areas of Hot-Dip
Galvanized Coatings**

ASTM D 6386



**Standard Practice for Preparation of Zinc
(Hot-Dip) Galvanized Coated Iron &
Steel Product & Hardware Surfaces
for Painting**

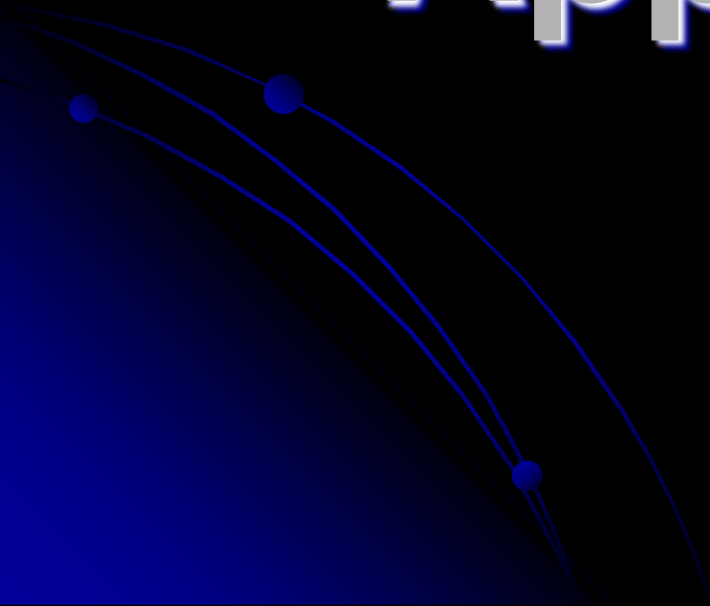
Butler County Bridge - Ohio



Stark County – Pro Football Hall of Fame Bridge



Real-world Applications



A photograph of the Stears Bayou Bridge, showing its concrete structure and support pillars. The bridge is a multi-level concrete structure with a light-colored upper deck and a darker lower section. The image is taken from a low angle, looking up at the bridge's underside. The text "Stears Bayou Bridge" is overlaid in white with a blue shadow. The background shows some greenery and a clear sky.

Stears Bayou Bridge

Stearns Bayou Bridge

MANAGER — WM.

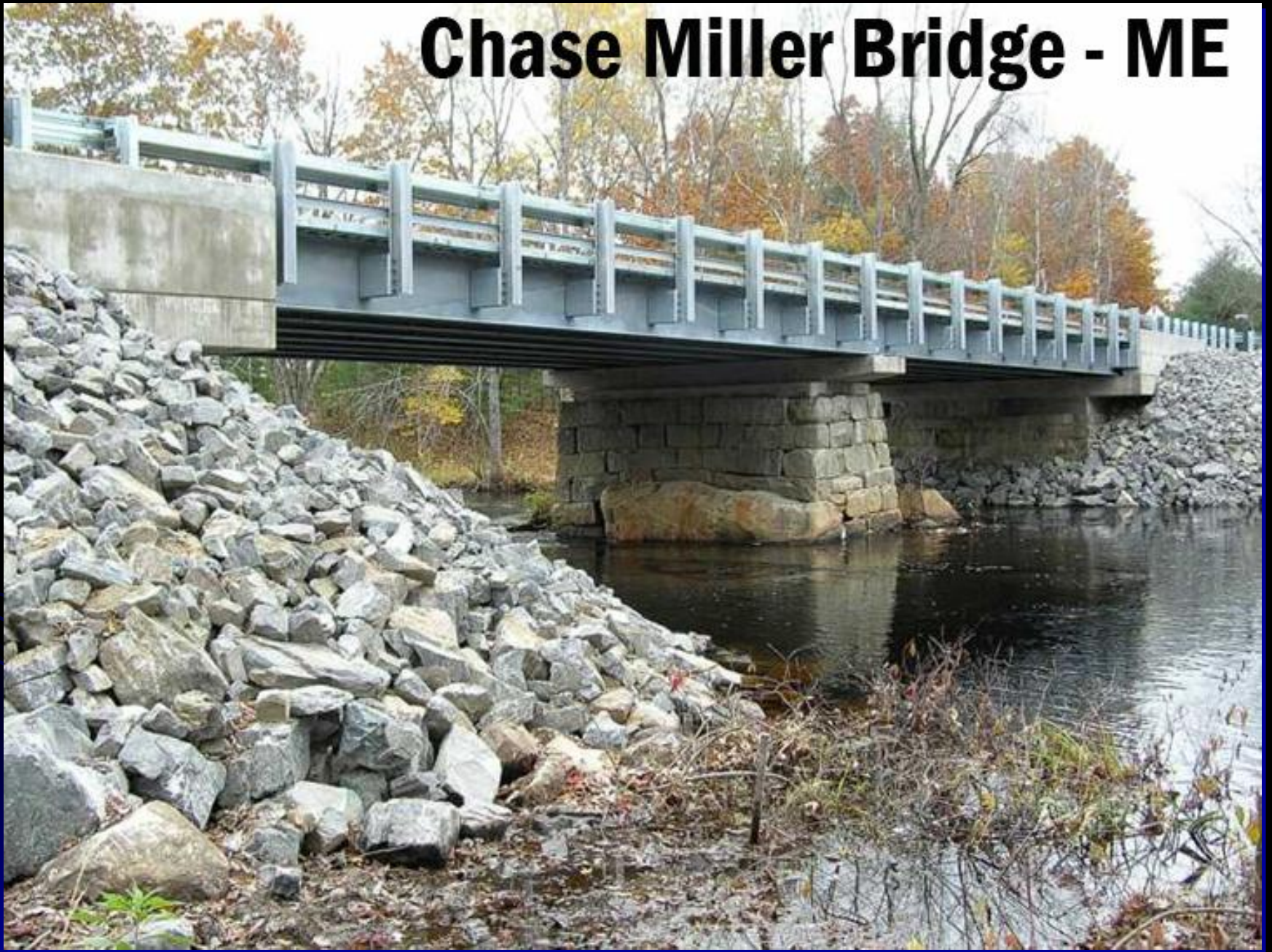
— 1966 —





Montgomery County - Maryland

Chase Miller Bridge - ME





Fallowfield Township – Washington County PA





Bryants Bridge – Saratoga County N. Y.

GalvanizeIt!

Thank You!

Kevin Irving

Marketing Manager Northern Ops

kevinirving@azzgalv.com

815-693-4242





Knox County, OH - Before



Knox County, OH - After



Seneca County, OH - Before



Seneca County, OH - After



Village of Glouster County, OH - Before



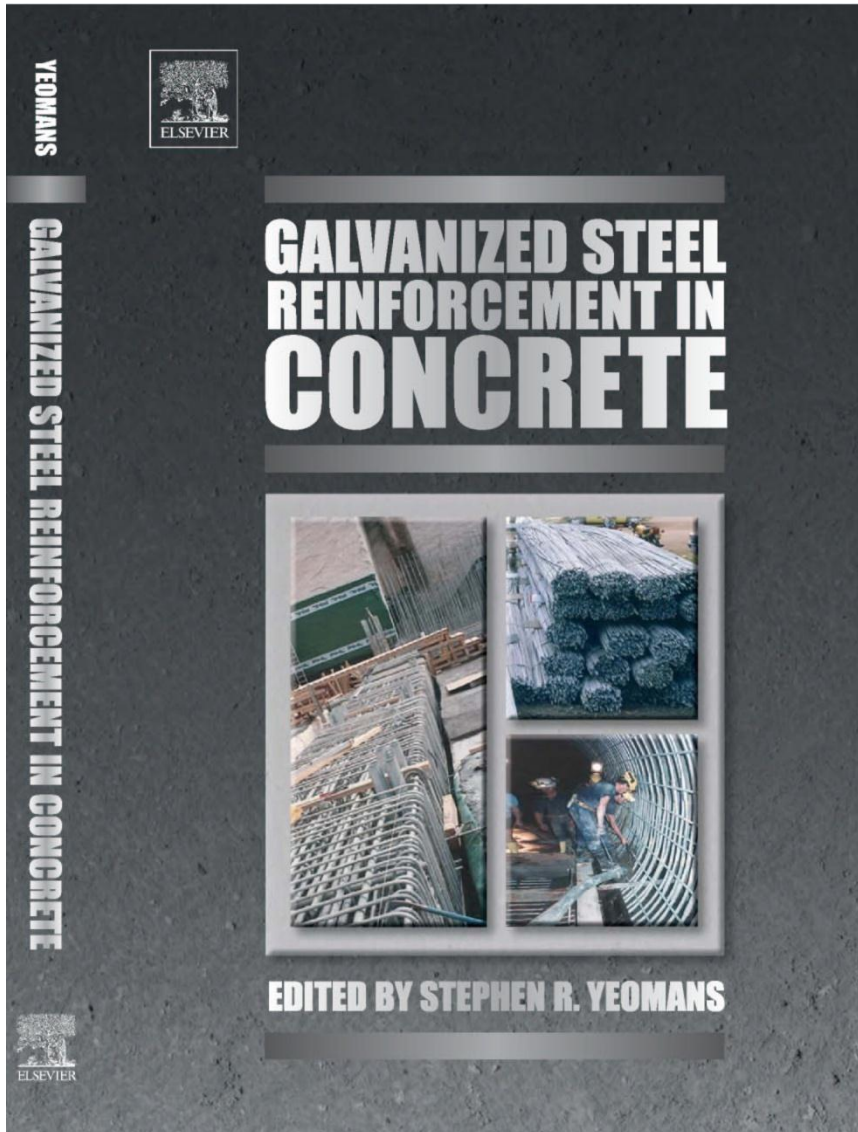
Village of Glouster, OH - After



Village of Minerva, OH - Before



Village of Minerva, OH - After



HOT DIP GALVANIZED REINFORCING STEEL
A CONCRETE INVESTMENT



Zinc *Protects!*



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GALVANIZED REBAR resource center


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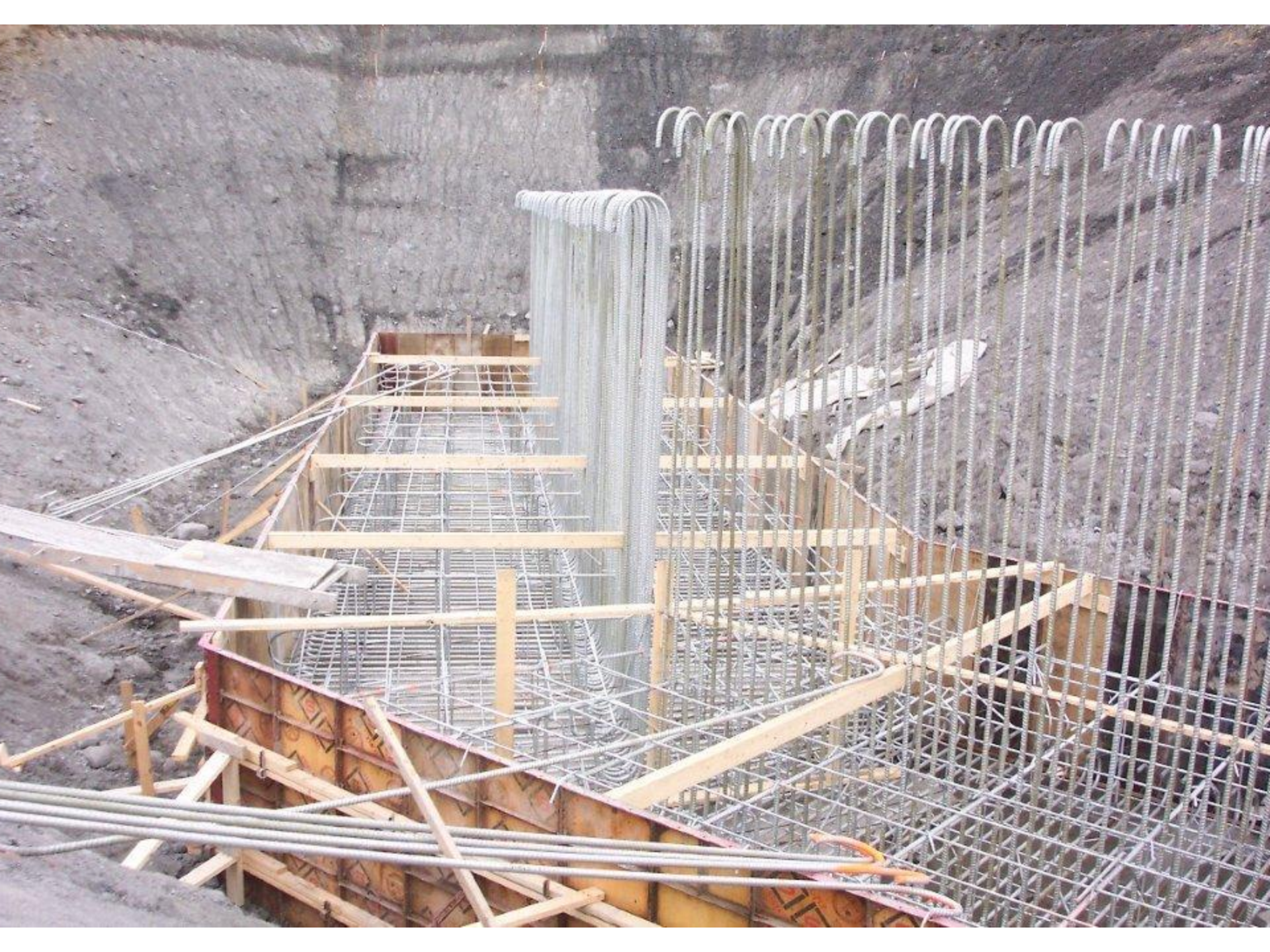
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Advantages of Hot Dip Galvanized Rebar

- Corrosion resistant
- Low cost
- Tough
- Long history of performance
 - 1948 Royal Navy Dockyards, Bermuda
- Higher bond strength















Lowes HQ Parking Garage

Electrical Utilities



Cellular

Clock Tower



Raleigh

North Carolina

Piers 1 & 21 Replacement

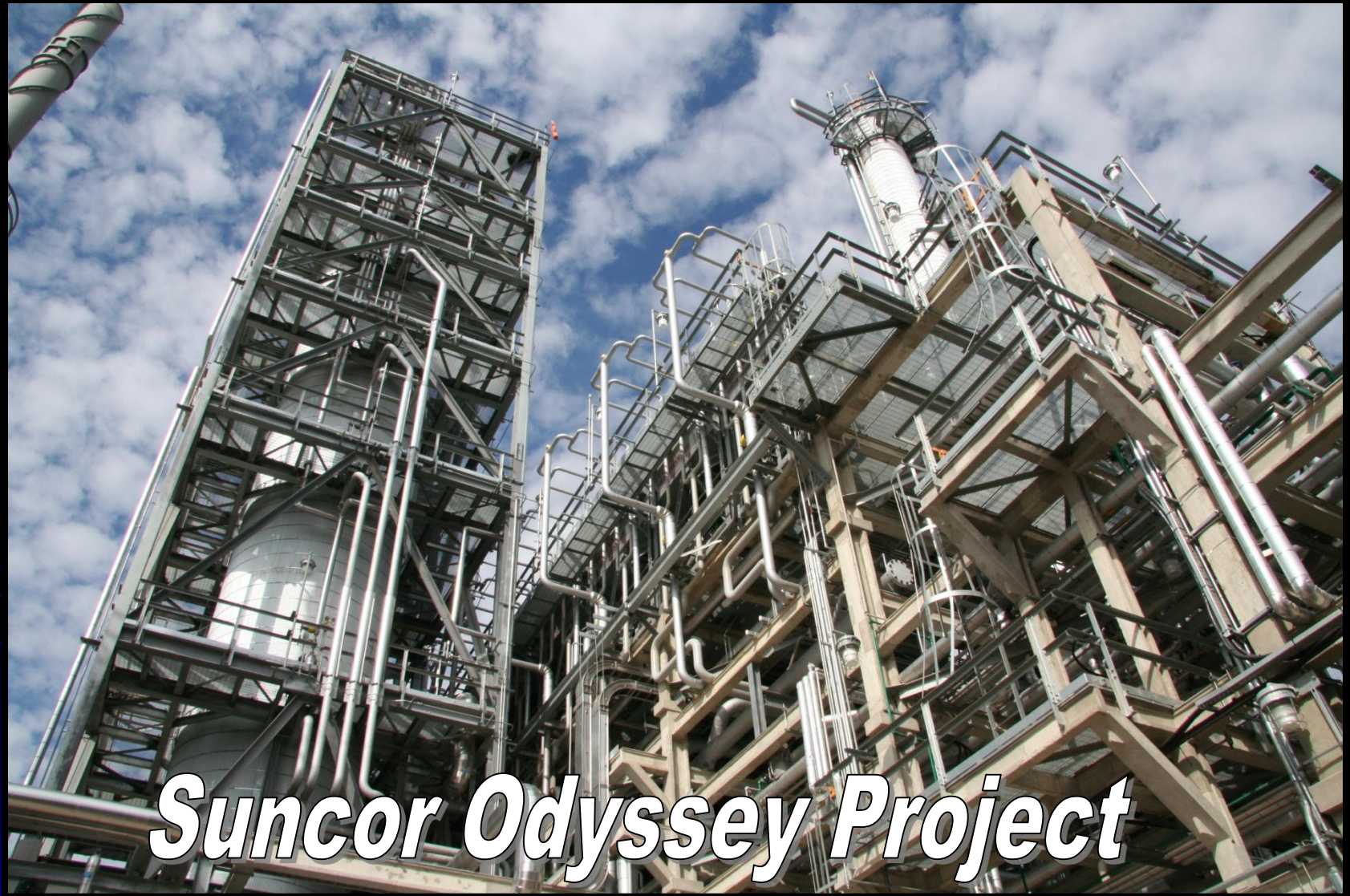
Date Galvanized
2002



Components Galvanized
Fenders and corner bolsters

Environment
Temperate marine

Location
Norfolk, WA



Suncor Odyssey Project



Harley - Davidson Museum



***Stephens Pnumatic
Bulk Trailer***



Texas Motor Speedway



Galvanized

Painted

Corrosion Problem – Case Study

The Williamsburg Bridge
built in 1903 in New York City



1991 inspection revealed severe corrosion
direct cost of repairs was \$750 million
indirect cost approximately \$8.2 billion

Law of Entropy

- Tendency for metal, after production and shaping, to revert back to its lower, more natural energy state or ore



Galvanic Series of Metals

ZINC = ANODE

STEEL = CATHODE



This arrangement of metals determines what metal will be the anode and cathode when the two are put in a electrolytic cell (arrangement dependent on salt water as electrolyte).

Zinc is Natural



Soil

Sacrificial Zinc Anode

In an “Electrochemical” Corrosion Cell, Zinc will sacrifice itself consistently and rapidly as long as all of the Corrosion Elements are present (i.e. Anode, Cathode, Electrolyte & Return Current Path)

(Accelerated Corrosion Testing)

Sacrificial Zinc Anodes

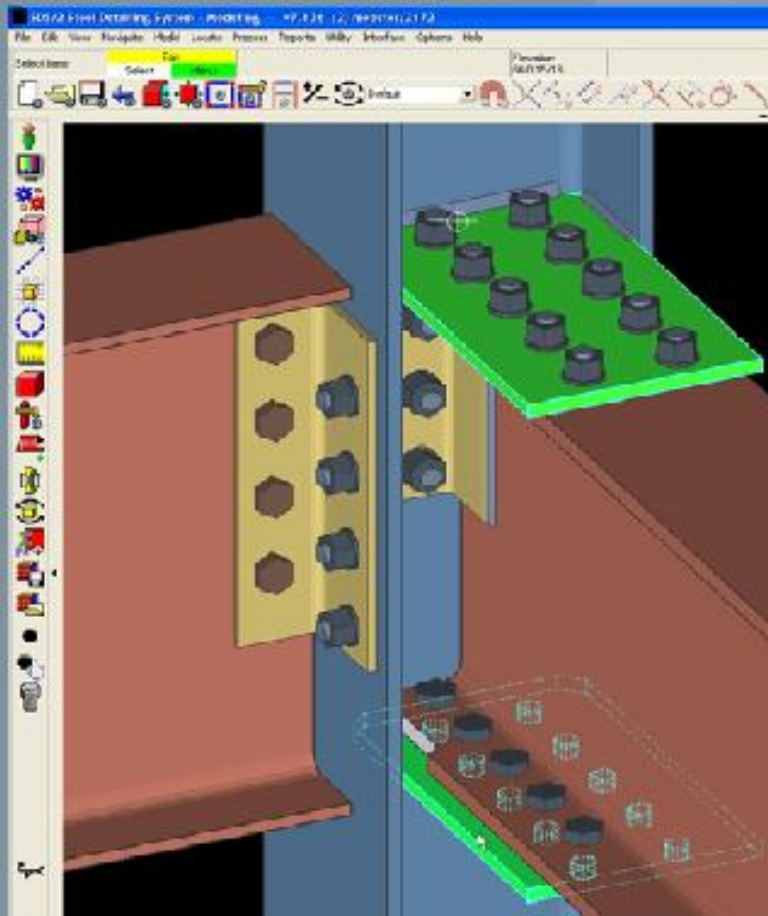


Corrosion of Bare Steel

- Microscopic anodic and cathodic areas exist on a single piece of steel
- As anodic areas corrode, new material of different composition is exposed with different electrical potential



SDS/2 - GALVANIZING



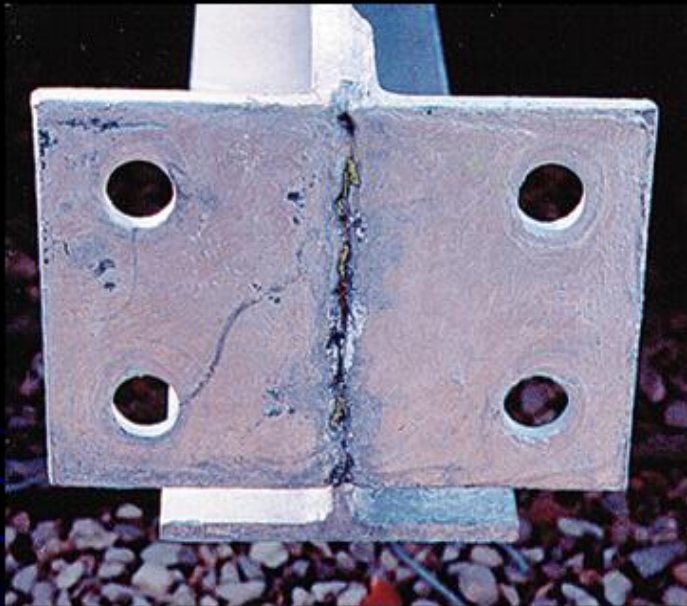
- † Details automatically loaded
- † Venting and Drainage provided
- † Software version in work

Galvanize It!



***Stephens Pnumatic
Bulk Trailer***

Seal Welding

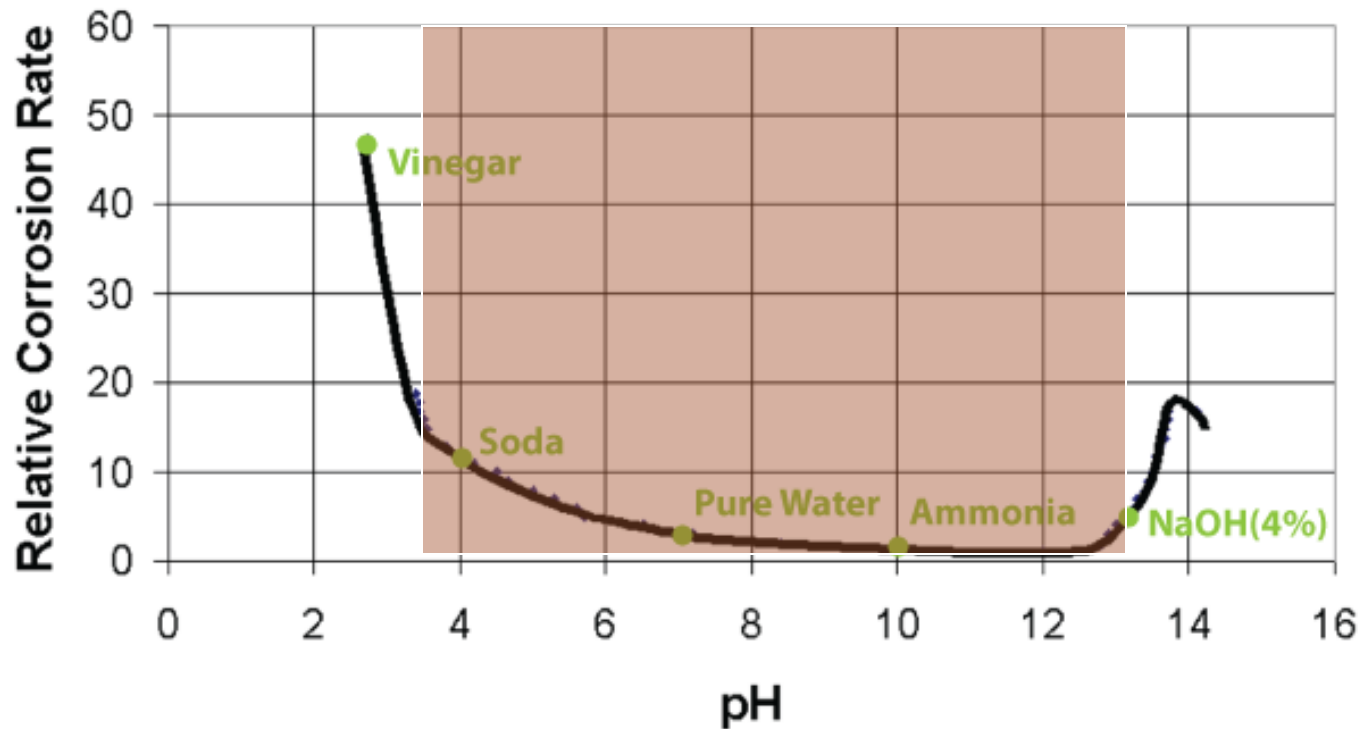


- Viscosity of zinc prevents it from entering gaps less than $3/32$ "
- Complete seal-welding or stitch-welding with at least $3/32$ " gap between surfaces



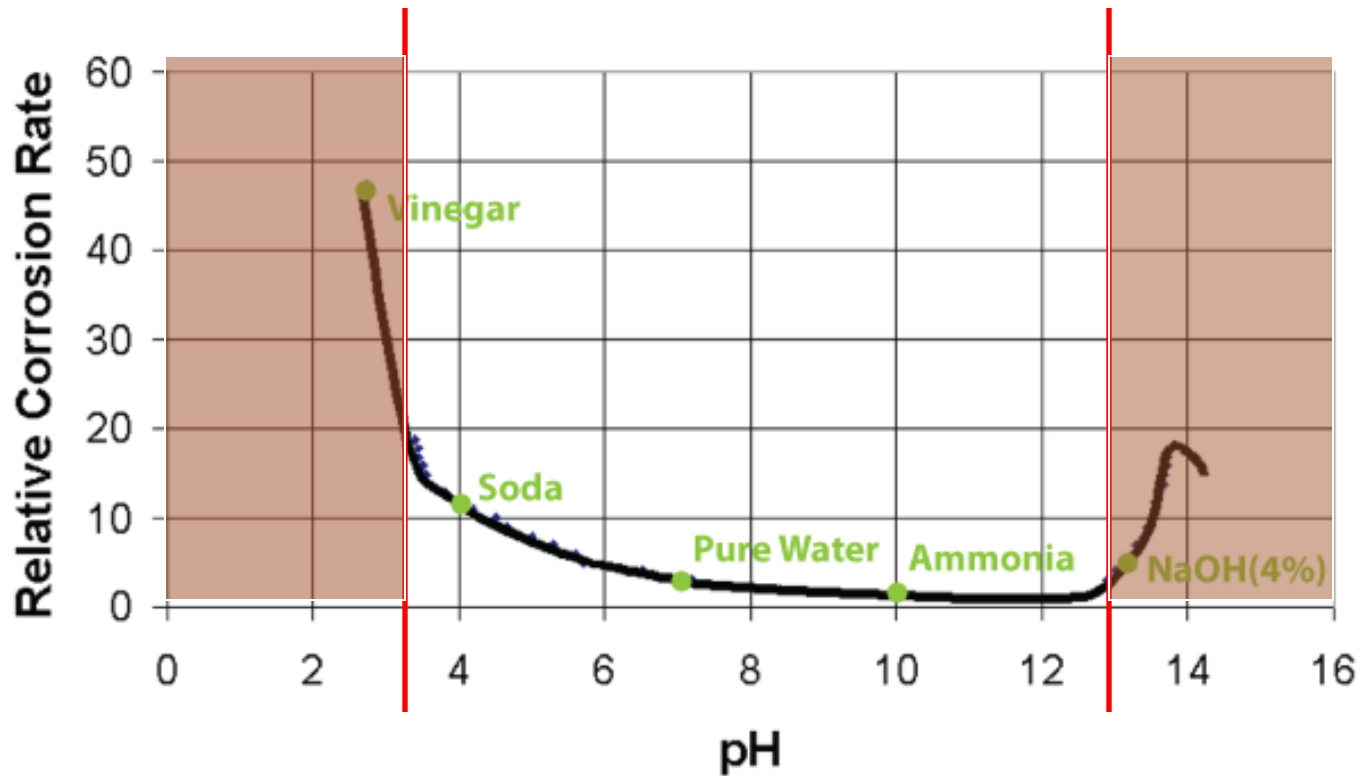
Electrochemical Corrosion Zone

Corrosion Rate of Zinc vs. pH



Chemical Corrosion Zones

Corrosion Rate of Zinc vs. pH













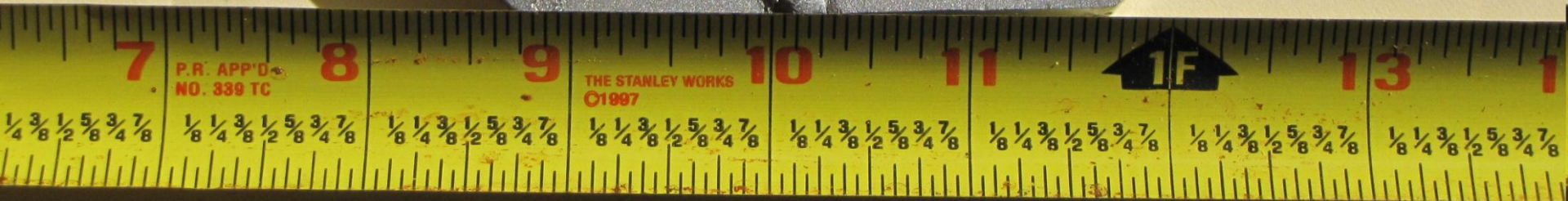


Services, Inc.





AZZinc Touch-up





APP'D
339 TC

8

9

THE STANLEY WORKS
©1997

10

11

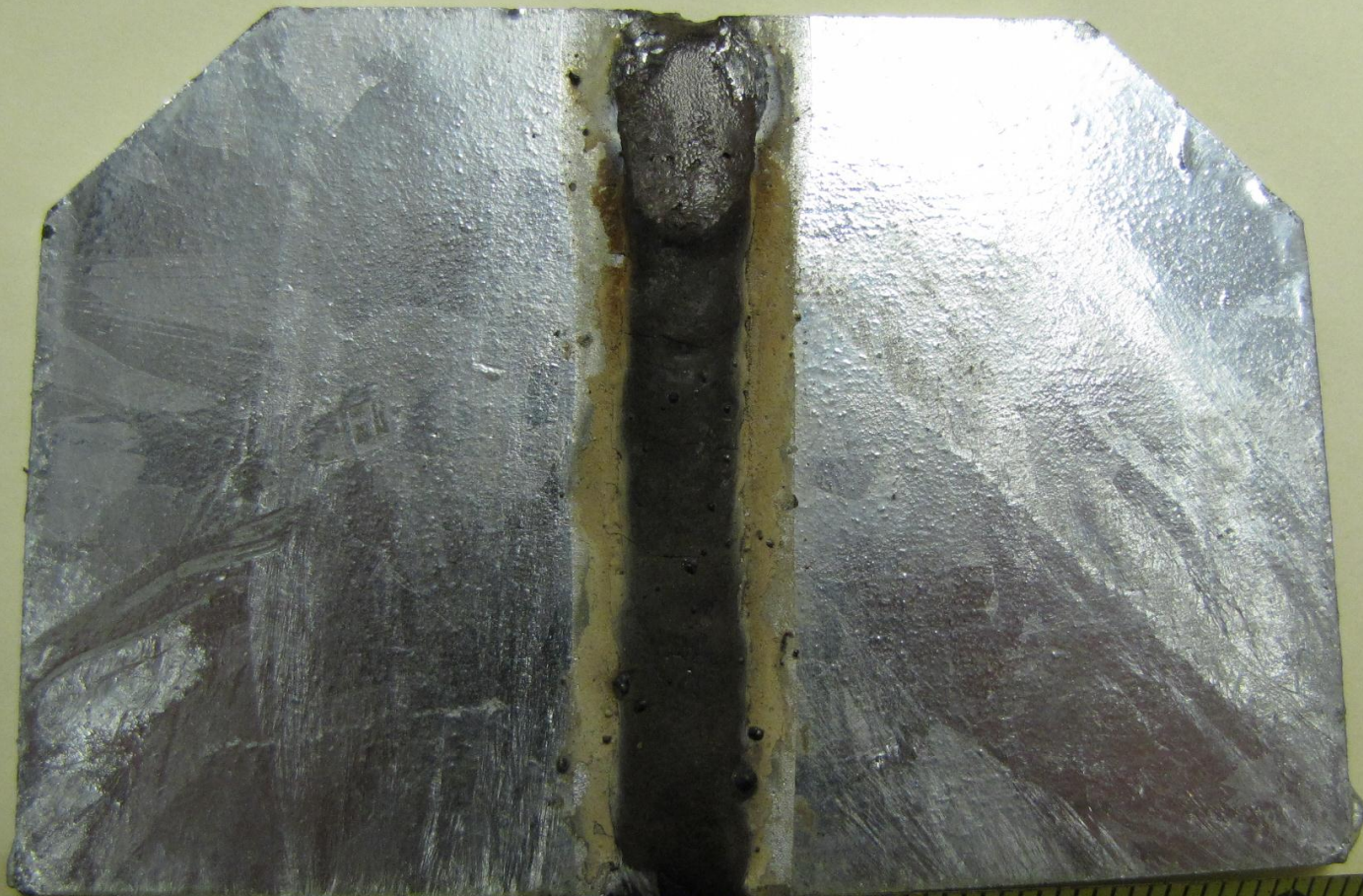


1F

1/8 1/4 3/8 1/2 5/8 3/4



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