

GPI

Greenman-Pedersen, Inc.



Applying Protective Coatings to a Range of Bridge Substrates

Bobby W. Meade

Greenman Pederson Inc.

Theodore Hopwood II, P.E.

Kentucky Transportation Center

Traditional View of Protective Coatings

- **Prevention of corrosion on steel bridge members**
 - **New structures**
 - **Maintenance painting**
 - **remove & replace**
 - **repair**
 - **overcoat**
- **Differences**
 - **Surface preparation & application methods**
 - **Coatings**

New Bridge Painting

- **Abrasive blasted substrates (NACE No. 1/SSPC SP5)**
 - Applied to non-corroded/uncontaminated steel
- **Shop application of zinc primer part of 2-3 coat systems**
- **Fewest painting problems**
 - Longest service lives

Fabrication Shop Painting



Pictures Courtesy of High Steel

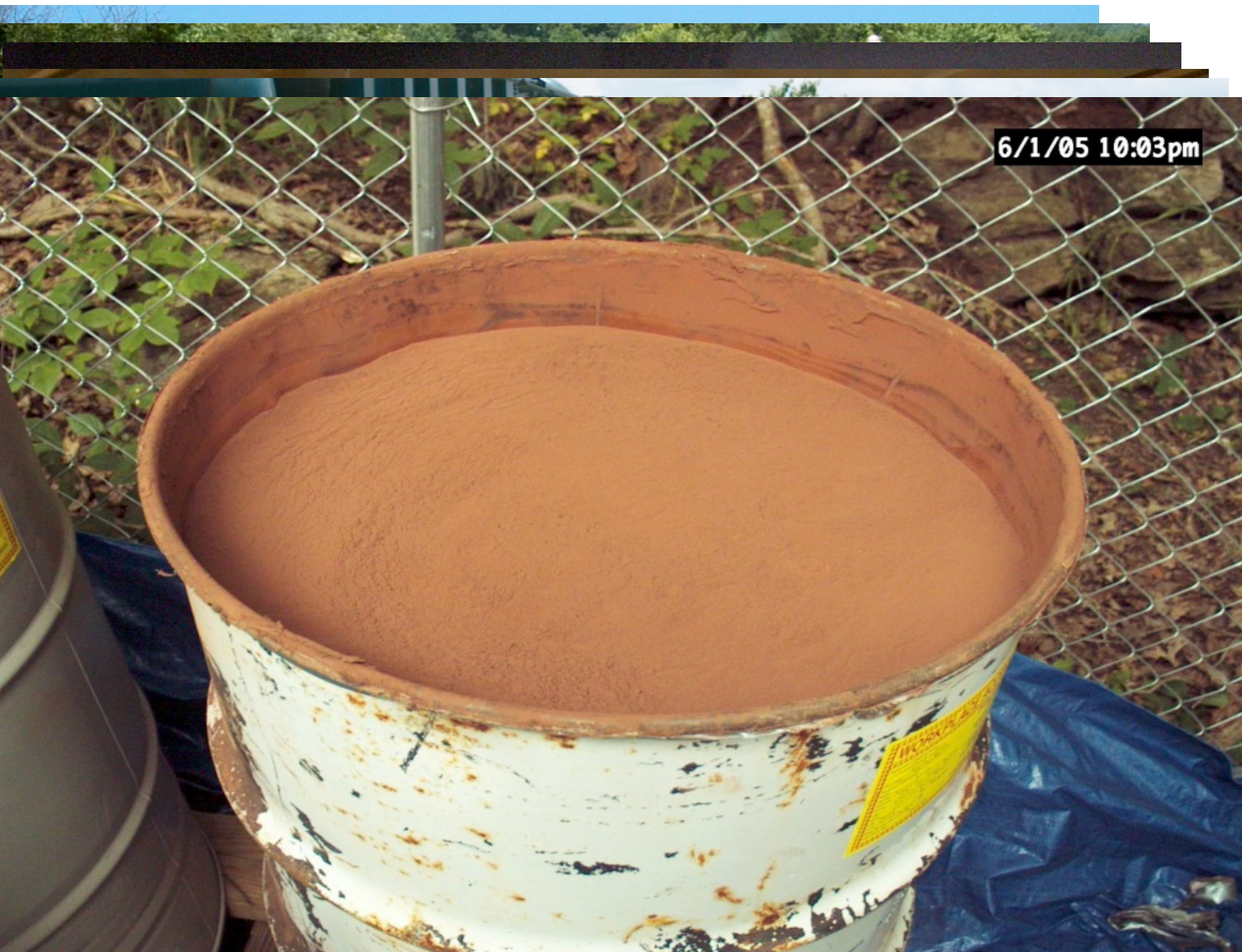
Maintenance Painting

- **Remove & Replace**
- **Repair**
- **Overcoat**

Removal & Replace

- **Similar surface preparation & coatings to shop painting**
 - **Difficult conditions**
- **Surface preparation < shop painting**
 - **Soluble salt contamination a problem**
- **Service life < coatings on new steel**

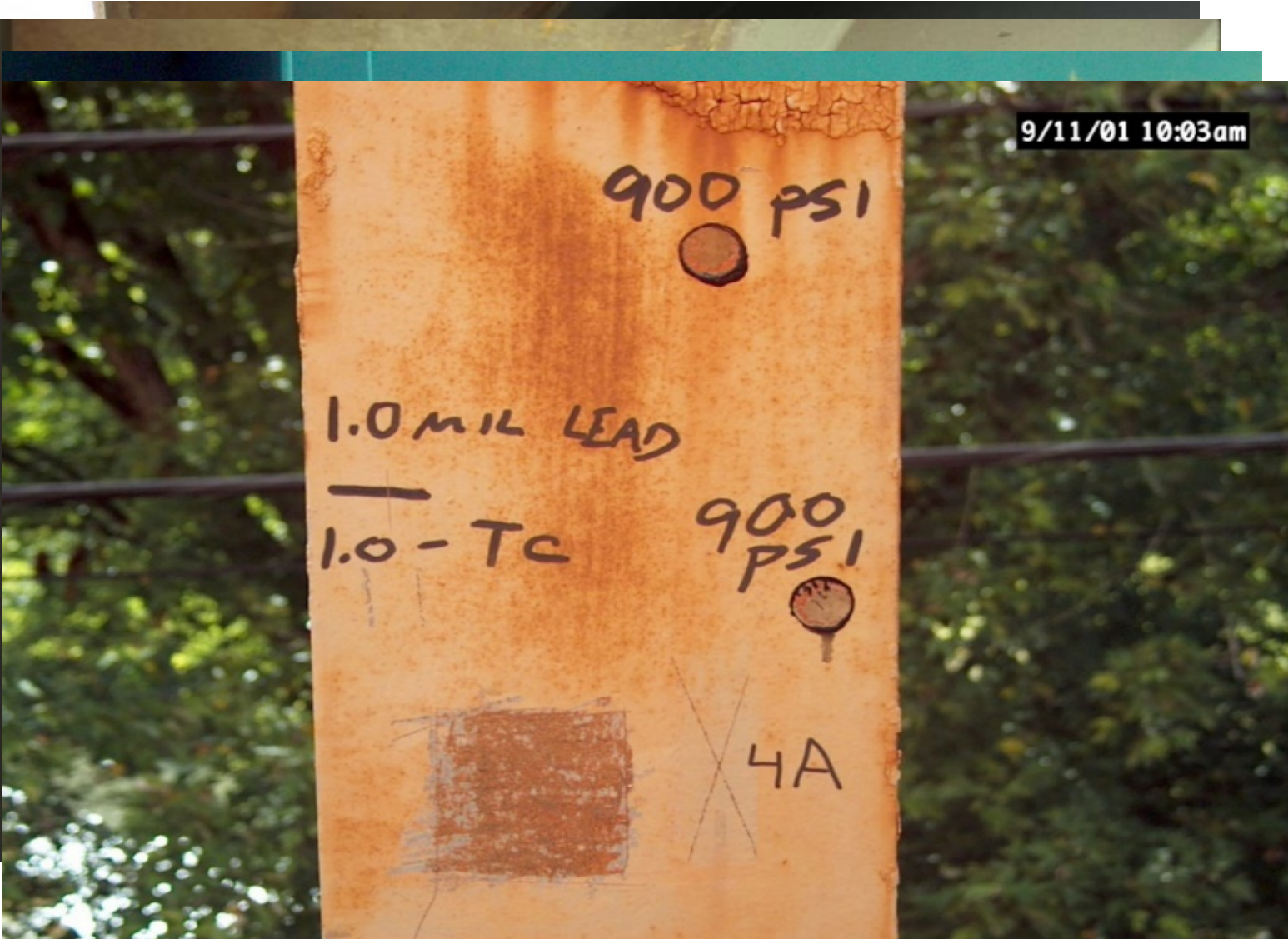
Total Removal



Repair

- **Spot or Zone**
- **Consider the existing coating**
 - **Compatibility**
 - **Condition**
- **Must address condition of existing steel**
 - **Rough substrates & pitting**
 - **Soluble salt contamination**

Evaluation of Existing Coating



Spot Painting



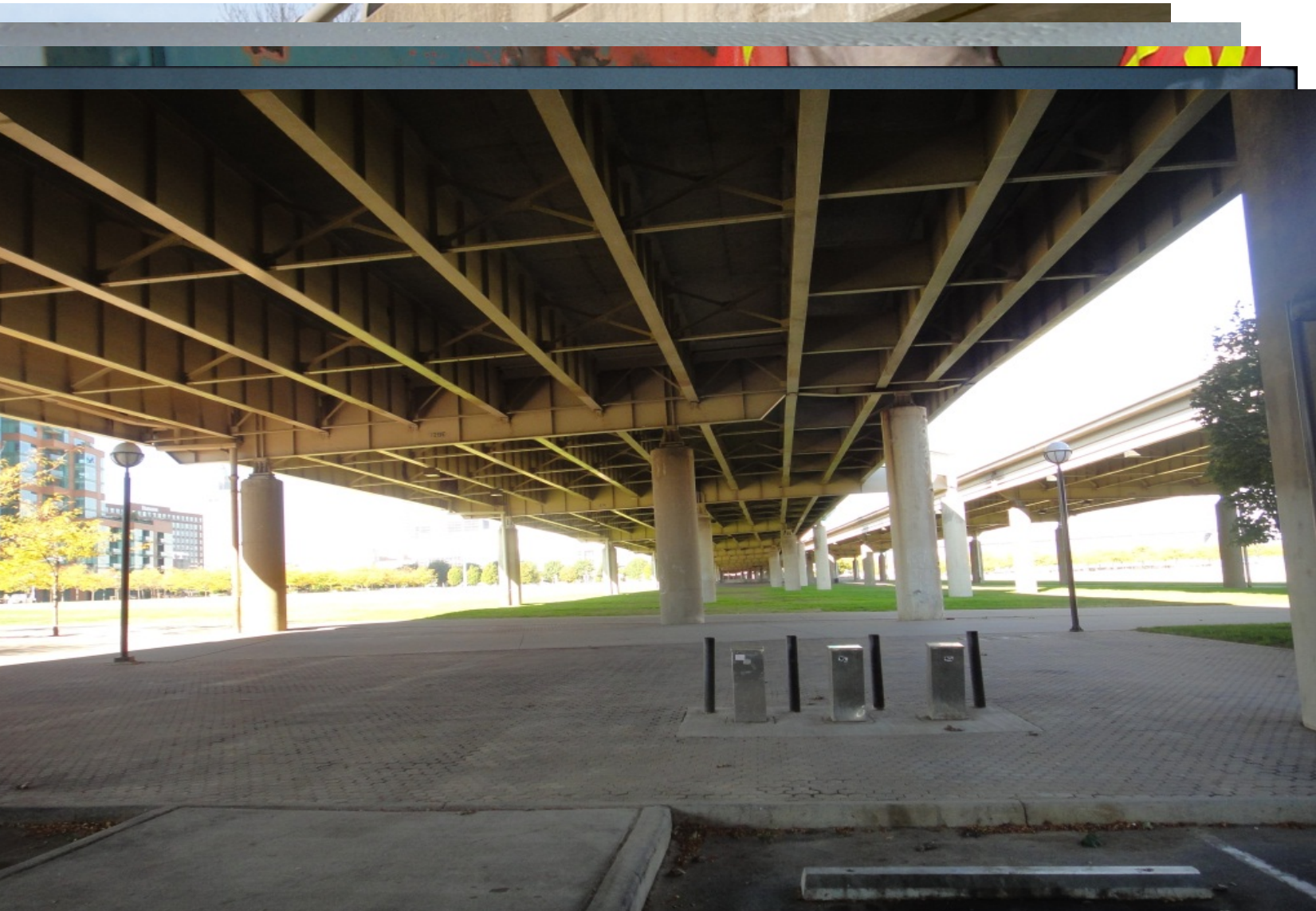
Zone Painting



Overcoating

- **Encapsulation**
- **Consider the existing substrate**
 - **Material compatibility**
 - **Proof testing**
 - **Soluble salt contamination**

Overcoating



Weathering Steels

- **Issues with unhindered corrosion**
 - Soluble salt contamination
 - Extended time of wetness
- **Aesthetics**

Weathering Steels



Emerging Challenges for Protective Coatings

- **New materials to be protected**
 - Reinforced concrete
 - Galvanized steel
 - Polymers
 - Composites
- **New types of protection needed**
 - UV protection
 - Fire/heat resistance
 - Moisture penetration
 - Extended service
 - Anti-icing
 - Aesthetics/anti-graffiti

Coatings For Reinforced Concrete

- **Damage due to deicing salts**
- **Cured and uncured concrete**

Protective Coatings for Reinforced Concrete



Surface Preparation



Painting Reinforced Concrete

- **Applying protective coating**
 - Typically a 1 or 2-coat system
 - Voids in coating are unavoidable

Painting Reinforced Concrete



Hot-Dip Galvanizing (HDG)

- **Shop application**
 - **Dipped in molten zinc bath**
 - **Forms four layers of zinc-iron alloys (pure zinc at surface)**
- **Concerns**
 - **Steel chemistry**
 - **Current standards and guides**

Hot-Dip Galvanized Steel



Hot Dipping



Thermal Spraying/Metallizing

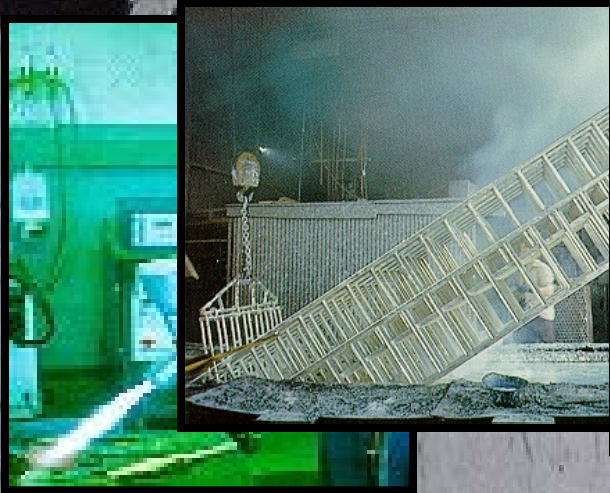
- **Used for structure corrosion protection**
 - Both shop and maintenance applications
 - Pure Zn, Zn-Al (85-15) and pure Al
- **The substrate is not melted**
 - Molten droplets hit substrate & solidify
- **Coating is porous**
 - Commonly sealed with low-viscosity resin
- **Requires NACE No. 1/SSPC SP5 White Metal Blast cleaned surface**

Thermal Sprayed Bridge Steel



Other Zinc Coatings

Metallized
Hot-Dip
Galvanized



ized
Electroplated

1 mil



Duplex Systems

- **Paint over HDG & Thermal Spray**
- **Painting over HDG**
 - **Requires special surface treatment**
 - **Blast-cleaned**
 - **Use of wash primer**
 - **Easier to coat after HDG is weathered**
- **Excellent service life**
 - **1.5 x individual service lives of (HDG + paint)**

Duplex Coatings



Duplex Coating – Surface Preparation to Top Coat



Polymers

- **Common application is for protective piping on stay cables/post-tensioning ducts**
 - **HDPE/polypropylene piping**
- **Polymer wraps/tapes are also used to protect suspension bridge and stay cables/piping**
 - **Proprietary systems (chlorosulfonated polyurethane)**
 - **Tedlar tape (polyvinyl fluoride film)**

Piping Material Deterioration



Piping Material Deterioration



Composites

- **Composites have been used on a few experimental bridges**
- **More common applications have been to strengthen concrete bridges**
 - **Design deficiencies**
 - **Vehicle impacts to overpass structures**
- **Potential issues with composites**
 - **Excessive moisture uptake**
 - **UV degradation**
 - **Fire damage**

Composites



Heat-Resistant Coatings

- **Primary problem is hydrocarbon fires**
- **Most common exposures**
 - **Overpasses**
 - **Bridge wires**
 - **Suspenders & fittings**
 - **Stay cables**

Bridge Fires



Miscellaneous Coatings



Conclusions

- **Traditional steel coatings are still a challenge**
- **Concrete will be the next big use of protective coatings**
- **Emerging substrates require coating protection**
- **Coatings can be used to address other problems as well**