

ASTM A588 Weathering Steel Guardrail



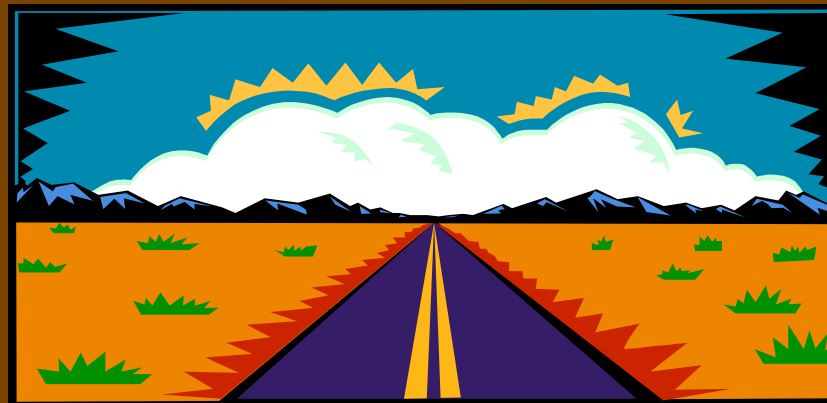
Why We Use Weathering Steel

- Aesthetics
 - Blends better with the environment



Where Do We Use It?

- National Forrest land
- Other scenic routes
- (and the mill yard)



Routine Maintenance Turns Up Problems in 1993

- Advanced Deterioration was discovered
- Beam Guardrail had rusted through at the point of overlaps along the Kancamagus Highway
- Preliminary Investigation showed:
 - Virtually all areas containing A588 Steel are within National Forest Lands
 - All showed some degree of failure

What Was Done

- Committee formed with members from:
 - Highway Design
 - Materials & Research
 - Districts
- Inventory and condition survey taken
- Other States surveyed on their use of Weathering Steel
- Correspondence with USFS to establish their position

Condition Survey 1995/1996

- Crawford notch
- Franconia notch
- Kancamagus highway
- Pinkham notch
- Waterville valley
- Lost river



Condition Survey Procedures

- Random thickness measurements taken
 - 1/8" holes drilled through steel
 - Appropriate depth gauges used to establish thickness
 - Field measurements compared to original thickness of 0.109"
 - 10% or greater section loss considered inadequate
- Age of Guardrail was established
- Condition of Weathering Steel was compared to galvanized rail of same age

How Was It Holding up?

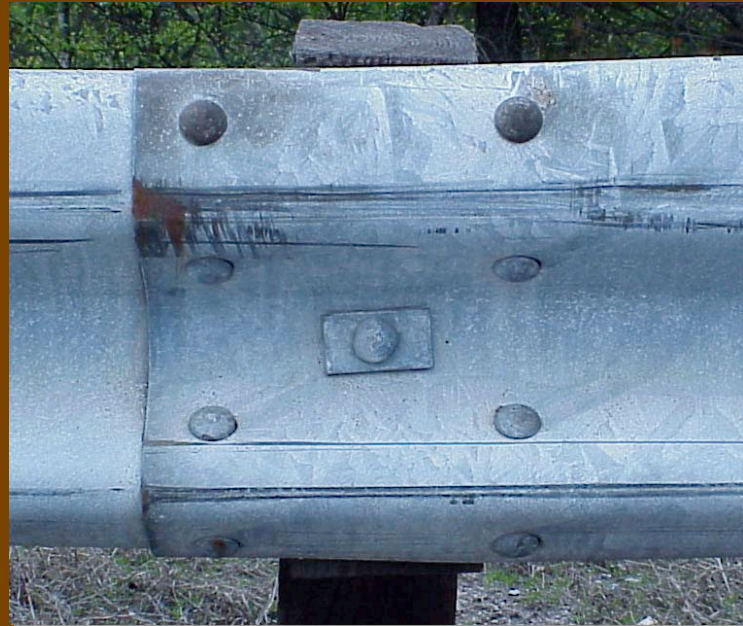
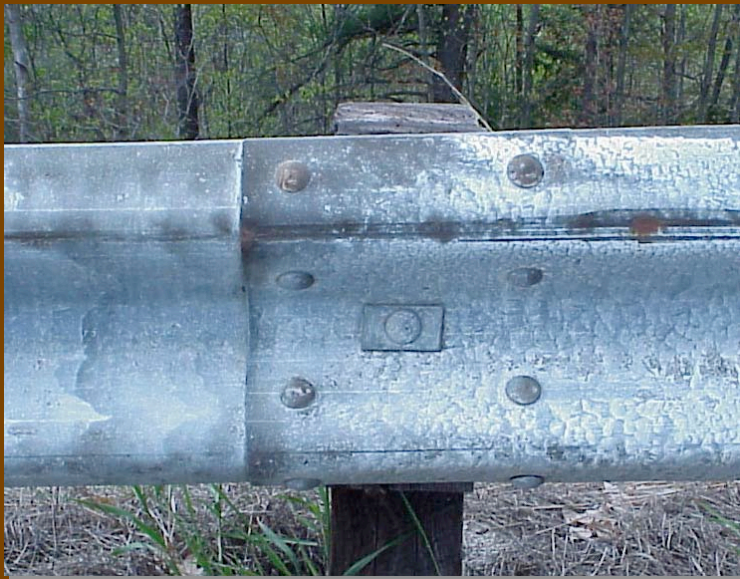
- After 10 – 15 years in service
 - ❖ 25% failure rate at mid-span
 - ❖ 50% failure at lap connections
- After 15 – 20 years
 - ❖ 25% failure at mid-span
 - ❖ 71% failure at lap connections



Note: Failure defined as 10% or more section loss

How about the Galvanized?

- Galvanized rail exposed to corrosive environments and equal years of service proved to be satisfactory
- Thickness tests showed no decrease from original dimension on all rail sampled
- Over time galvanized rail will become less shiny to a more environmentally blending appearance



Other States were Surveyed

- Does your State use A588 for Guardrail?
- If not, has it been used in the past?
- Reason for discontinuing use?
- Has your State conducted any Research related to corrosion or life expectancy?



Survey Says...



- 20 of 40 respondents do not use it
- Those who used to use it have stopped due to corrosion (Mich., Calif.)
- Those that do, use it in limited applications similar to ours

Correspondence with USFS

- USFS is aware of inherent problems
- Aesthetics is not the most important factor
- Safety and increased service life are very serious issues
- USFS would be very receptive to any ideas the Department has to address all concerns
- USFS has encouraged the use of galvanized rail in the past without negative response from the public

So What Can We Do ?

- Stop using it

That was the recommendation in 1997, but at that time the Department wanted to keep it as an option

- Research ways to make it last longer

Several Products Were Tried in Between the Sections

1. Control samples
2. Zinc inserts
3. Corrosion inhibitor
4. Fibered roof coating
5. Royston Tac-tape
6. Zinc-Hydrogel anode
7. Mc-Miozinc paint
8. Epoxy mastic coating



Then They Were Tested

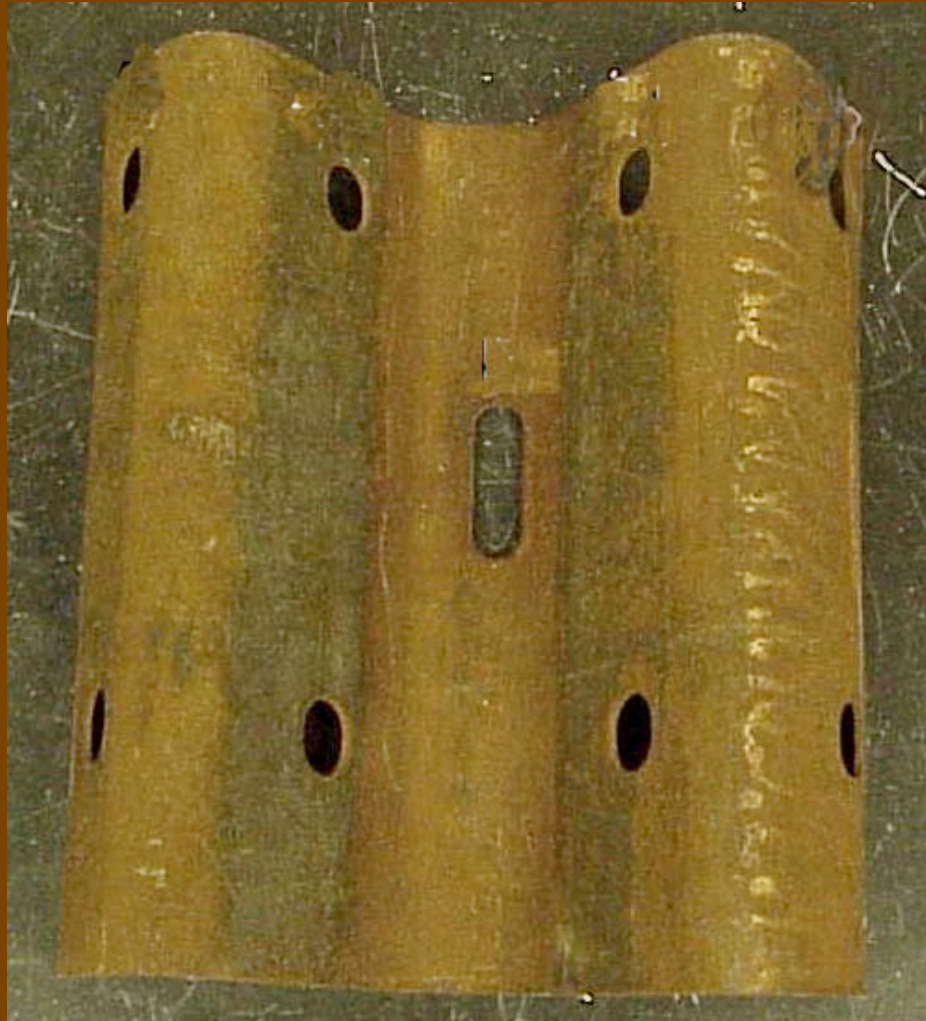
- Field samples were installed along I-293 in Manchester
- Laboratory samples were shipped to a consultant lab for testing. Those samples...
 - Were placed in an ASTM B117 salt fog chamber
 - Received 5000 hours in a 5% salt fog
 - Rusted, and rusted, and rusted
 - Were shipped back

2002 Review OF Field Samples

- No color difference In sections
- Some corrosion was present on edges of lap
- No great change in any section was expected due to short service life to date (Approx. 18 months)
- Field sections did seem to be following behavior of lab samples

*Samples will continue to be monitored for several years

The Salt-fog samples left
looking like this...

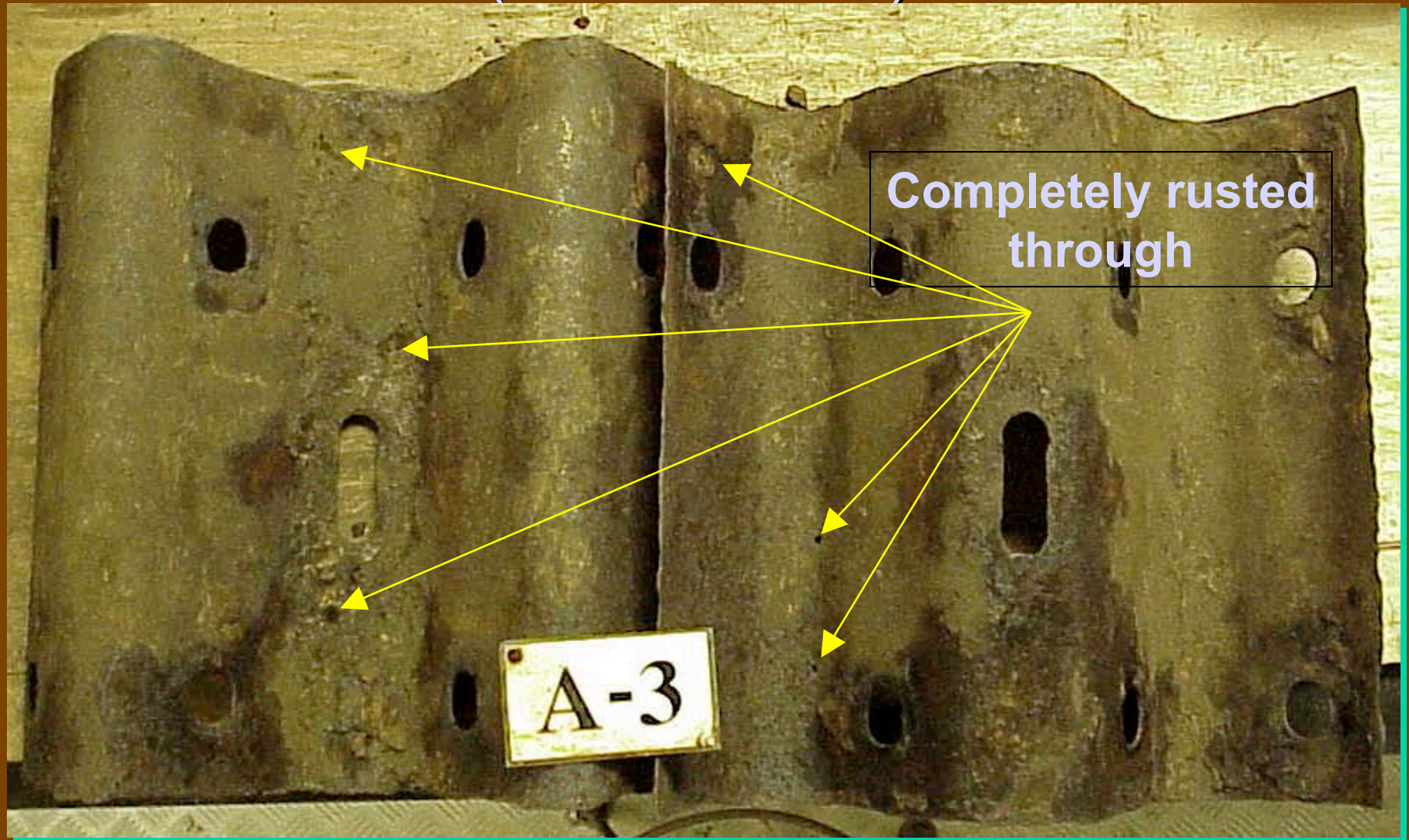


And Came Back Like This!



What a mess!

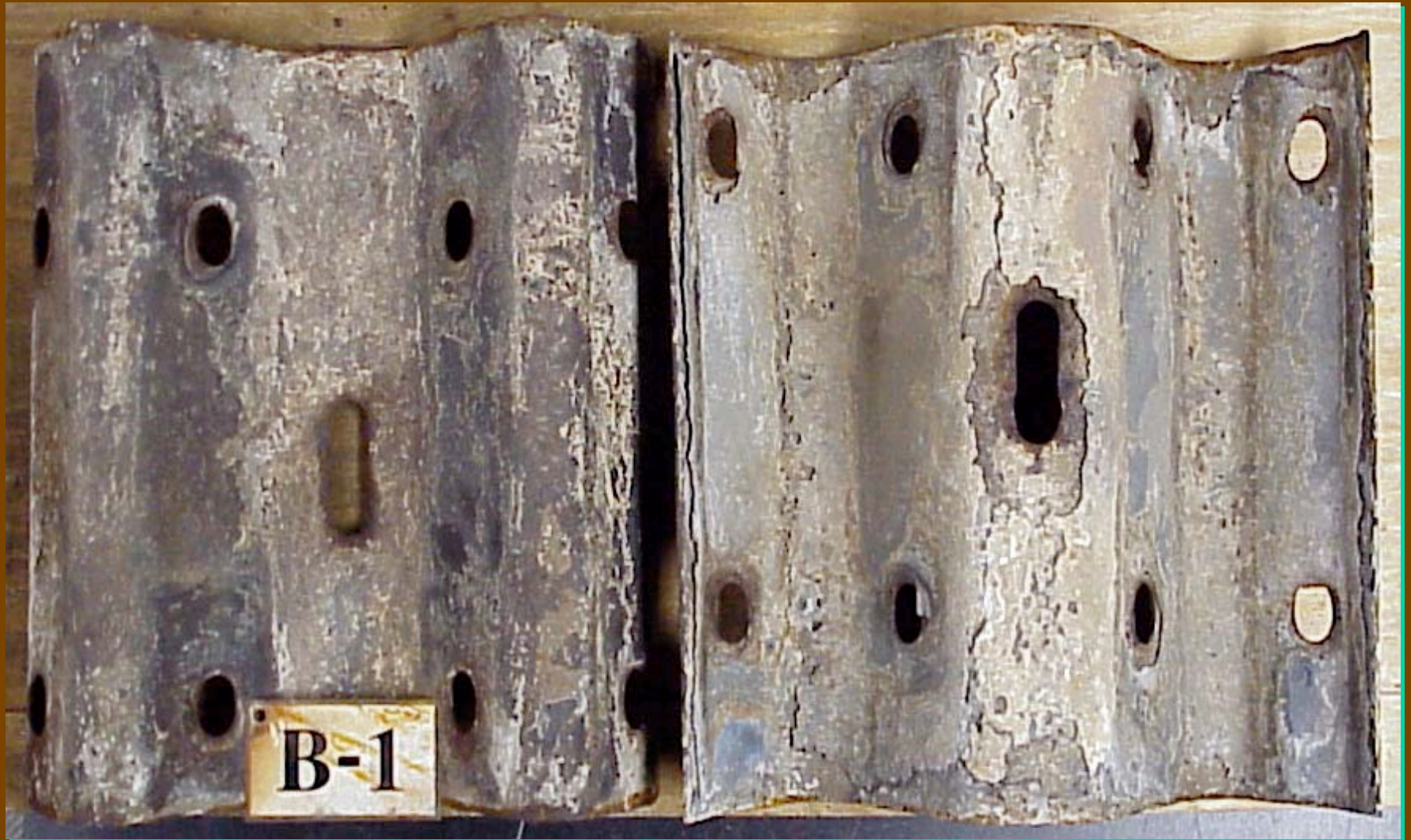
Control sample – post salt fog (Inside shown)



Zinc Insert Pre Salt Fog



Zinc Insert – Post Salt Fog





The Cost of Zinc



- Preliminary estimates are \$39 each per 1000
- This equals an approximate 22% increase from what we typically pay now...
 - Typical guardrail bid= $\$14.50/\text{LF} = \$76,560/\text{Mile}$
 - Laps every 12-__ ft = 423 Laps/Mile x \$39
= \$16,497/Mile
 - $\$16,497 \div \$76,560 \times 100\% = 21.5\%$
 - The cost will likely come down when put to bid

Recent Photos From Rte 112 – Lincoln

Photos by Brian Schutt



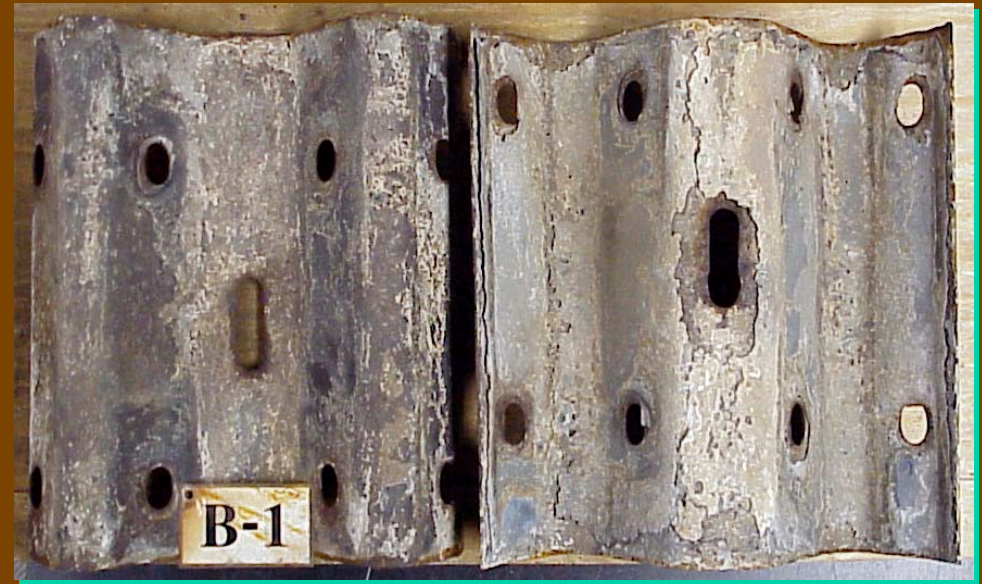
Conclusions - General

- Weathering Steel is not suited for use in corrosive environments
- In 1997 we had the support of the USFS to discontinue the use of Weathering Steel Guardrail
- Current condition of some rail is a inadequate



Conclusions on Zinc Research

- All coatings provided some level of protection to the side they were applied to
- The zinc inserts gave full protection to both sides
- The zinc inserts are the easiest, fastest and cleanest option
- With Zinc, the joints will no longer be the failure point



Other Recent Photos



Recommendations

- **Discontinue use of Weathering Steel Guardrail**
- **If we are going to continue using Weathering Steel Guardrail...**
 - We should start using zinc inserts
 - Revisit mid-span locations to verify 10% or greater section loss is remaining constant
 - Continue to monitor long term performance of zinc

