Use Of High-Performance A710 Grade B Steel in Construction of Lake Villa, IL Bridge

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Presentation

- Properties of A710 Grade B Steel
- Steel for Lake Villa Bridge
- Fabrication of Girders
- Bridge Construction

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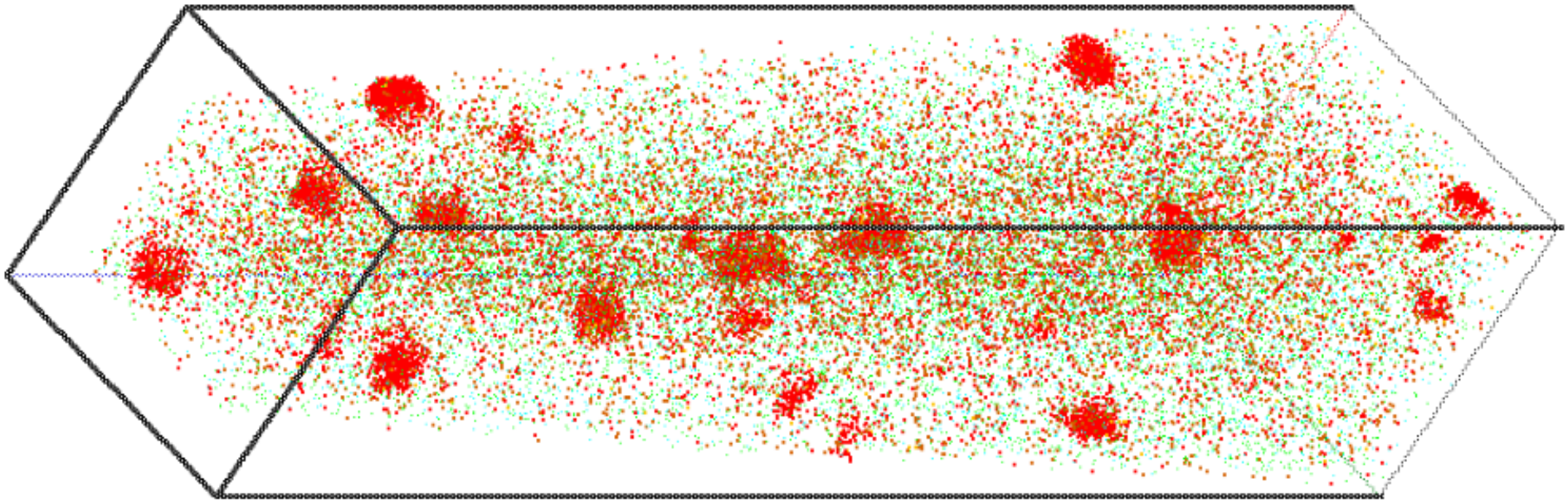
- No chromium or molybdenum → lower cost, health advantages

Steel Composition*

C	Mn	P	S	Cu	Si	Ni	Cr	Mo	Nb
0.07	0.69	0.009	0.001	1.34	0.40	0.90	0.05	0.05	0.035

* 5 heats of steel produced at ISG (now Mittal Steel USA) for Lake Villa Bridge

Precipitates in Cu-Precipitation-Strengthened Steel

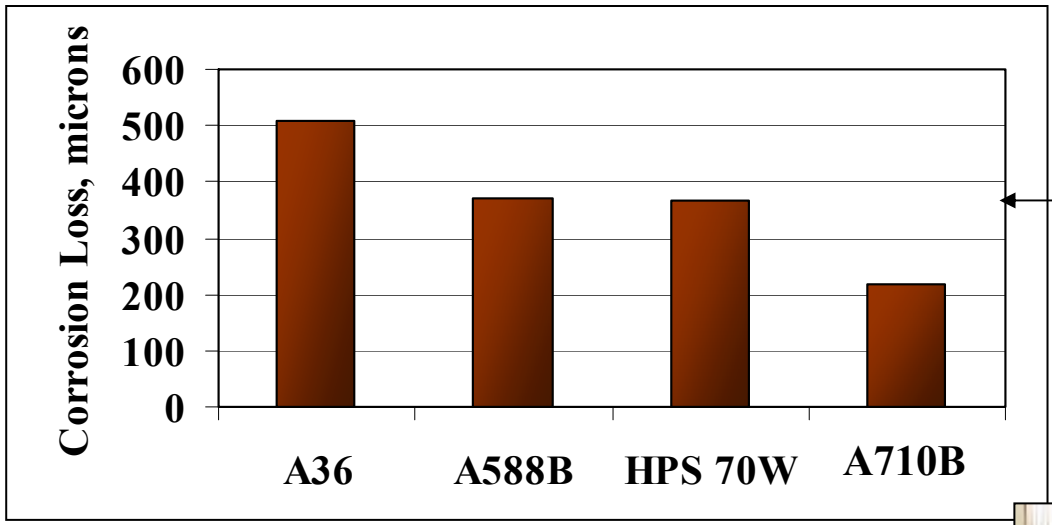


1,36 Cu, 0.85 Ni, 0.45 Mn steel, 0.06 C
Solution treated and aged to maximum strength
Red = Cu, Green = Ni. Fe not shown

Box dimensions $14 \times 14 \times 101$ nm^3

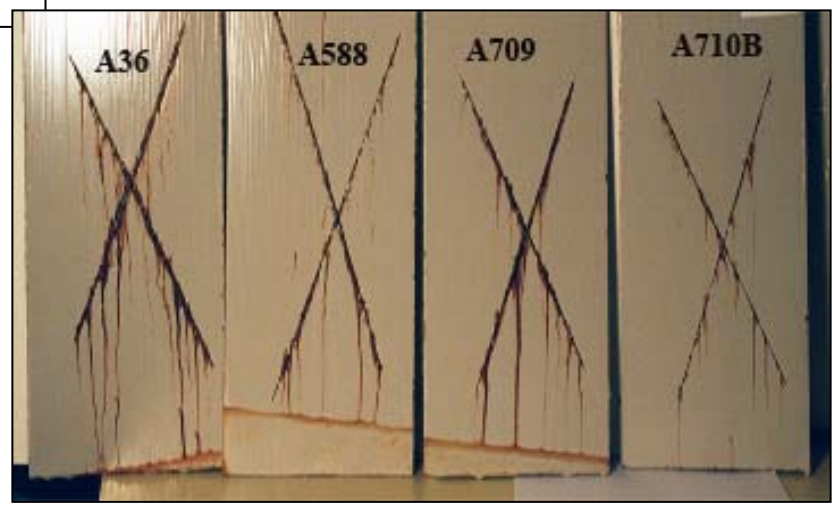
Courtesy of Dr. D. Isheim

Corrosion Evaluation

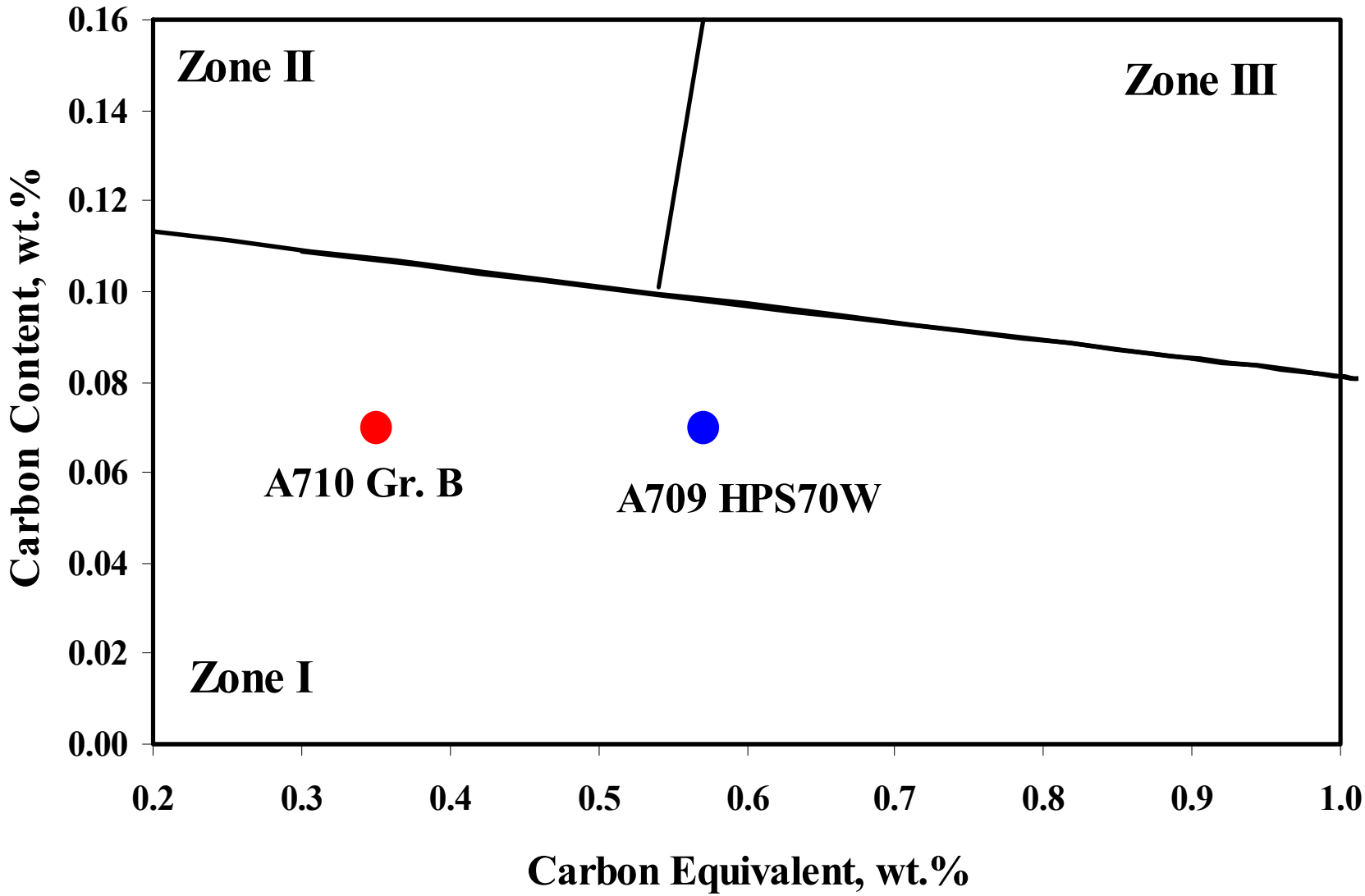


Accelerated Corrosion Test (Automotive SAE J2334 Standard)
Performed at Bethlehem Steel Company (now Mittal Steel)

PAINTED STEEL PANELS AFTER 3-WEEK, 35^{O}C EXPOSURE IN SALT-FOG CHAMBER



Welding – Graville Diagram



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- Duplicate G-BOP tests performed at US Steel Company (53 kJ/inch) --- no cracks in the welds or base plates

Machinability

Tests performed by Machining Research Inc. (contracted by IDOT) on A36, A709 HPS70W and A710 Grade B steels

Conclusion: “The A710 steel consistently showed the best machinability”

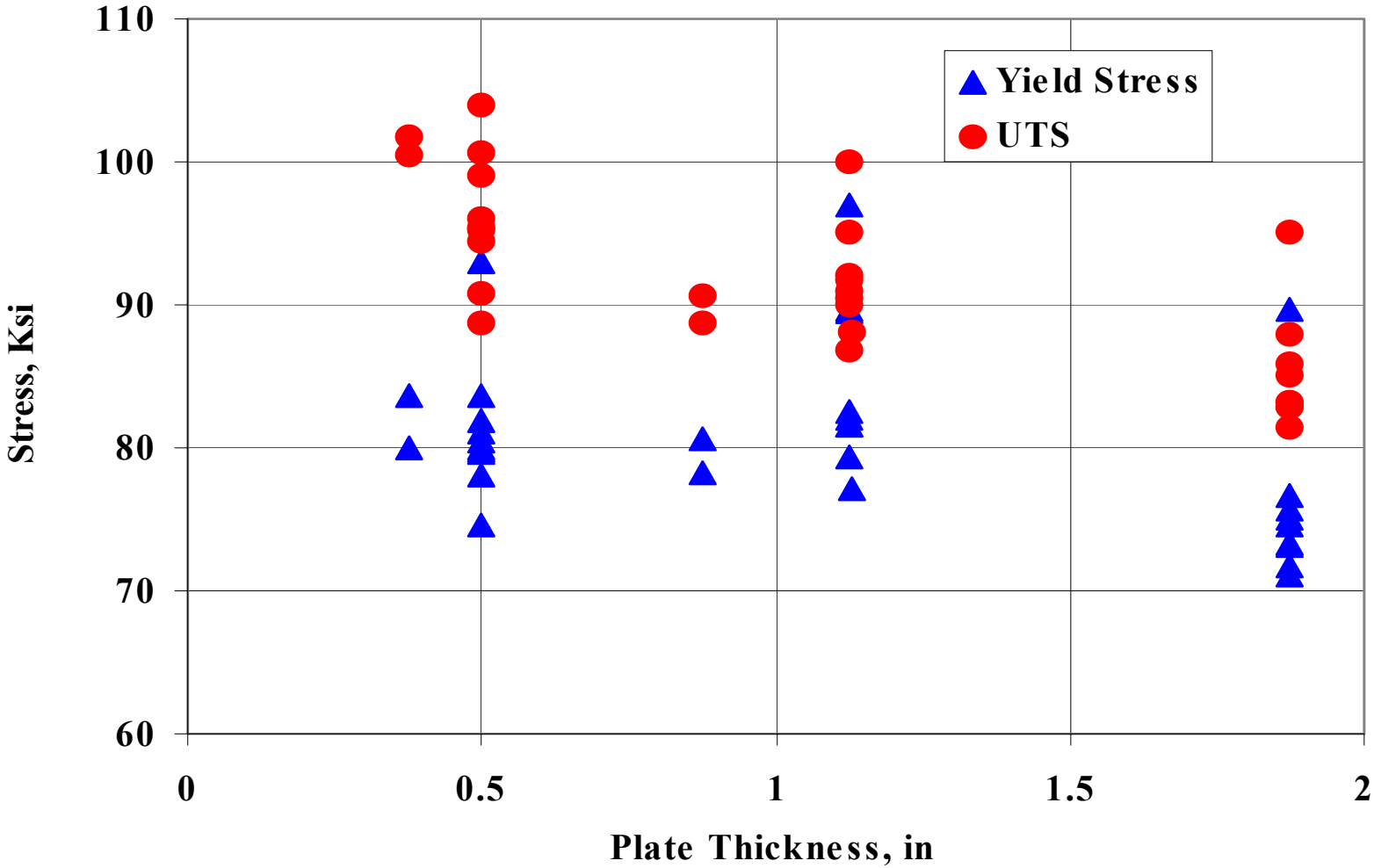
Lake-Villa Bridge

Bridge Location

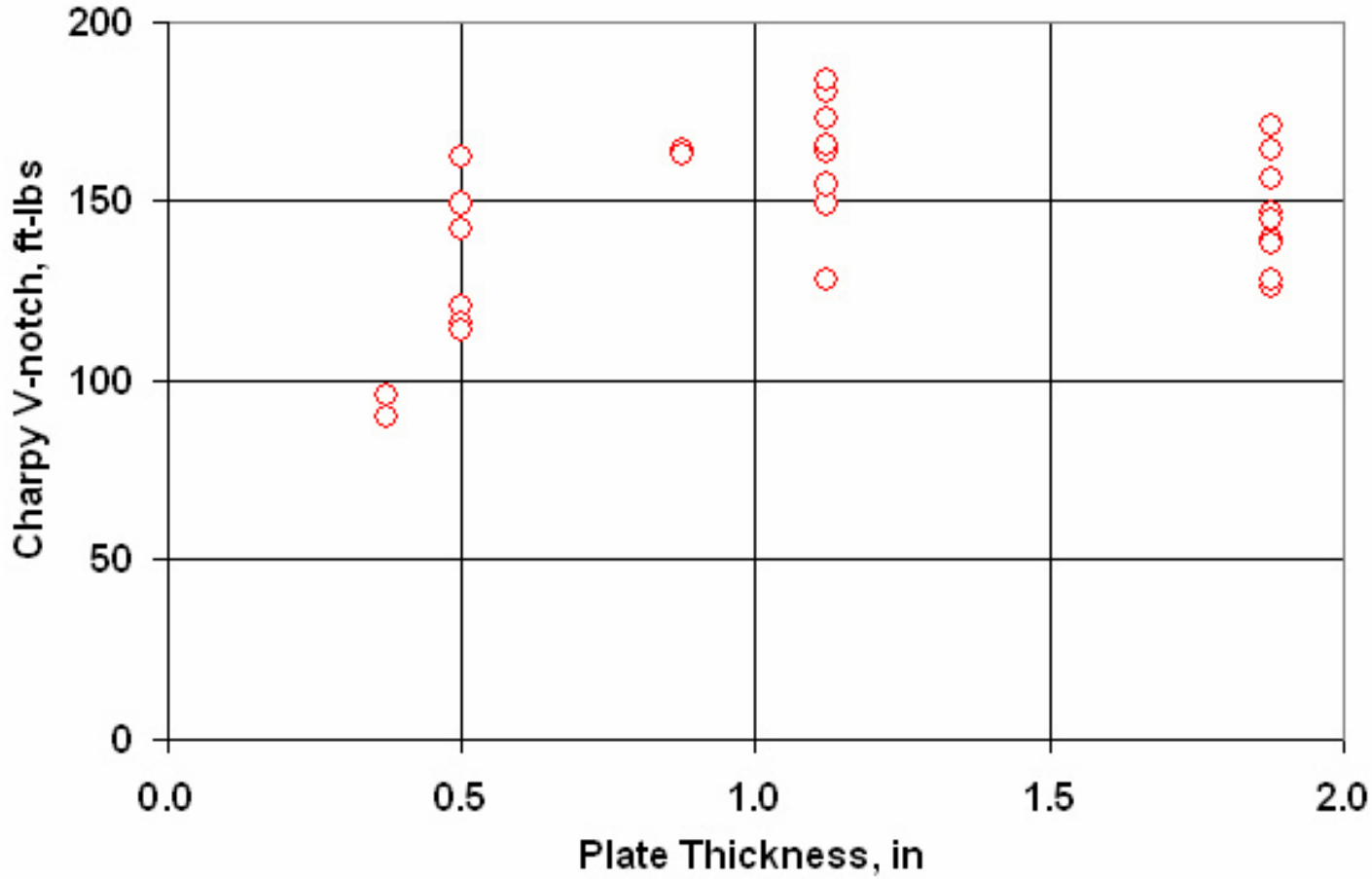
Bridge Specifications

- Continuous span length of 430.6 ft
- Only two new piers (before eight piers)
- Plate girders -½” thick web plate, with 1.125” x 16” bottom flanges, and 0.875” x 16” top flanges in the composite areas
- In sections over piers the top and bottom flanges are 1.875” x 16”
- Submerged arc welding (Lincoln LA-75 (AWS ENi1K), 3/32” diameter electrode, with a neutral Lincolnweld 960 flux)

Strength


110
100
90
80
70
60
0
0.5
1
1.5
2
Stress, Ksi
Plate Thickness, in
Yield Stress
UTS

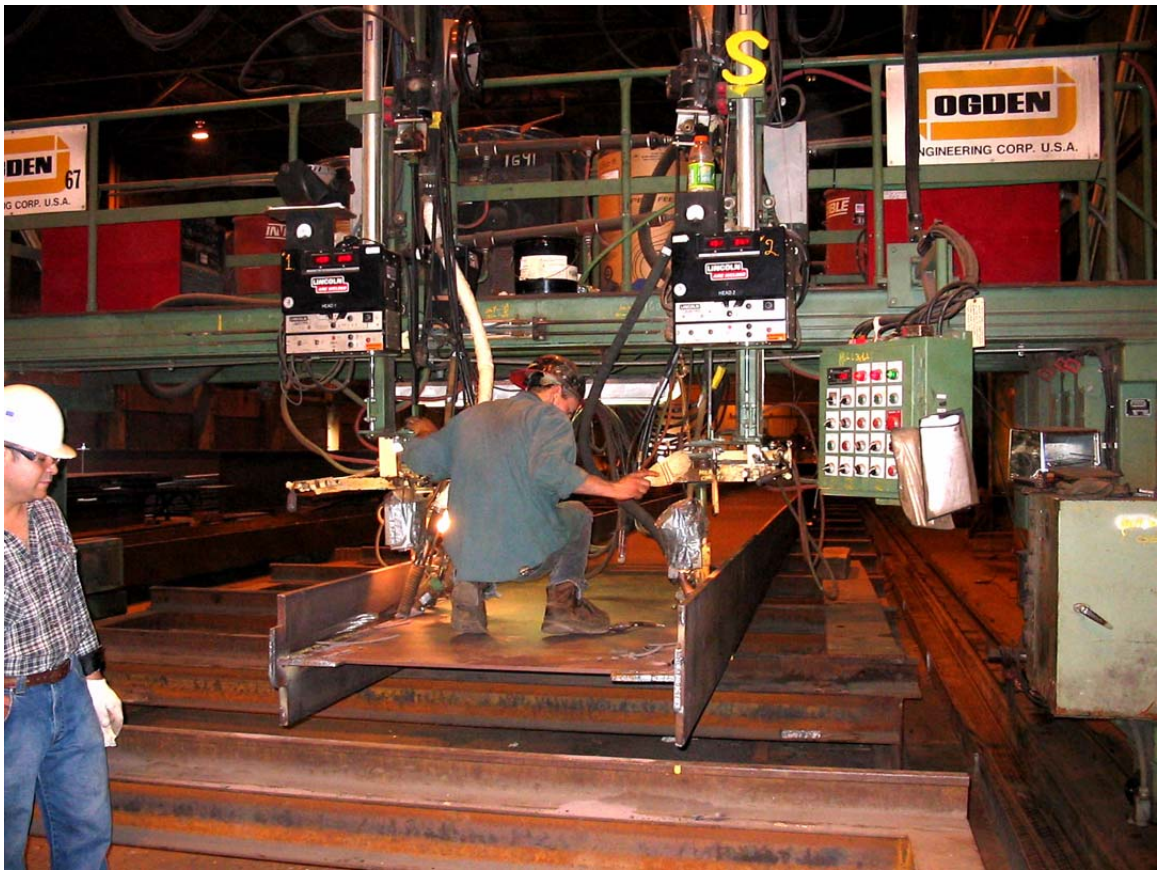
V-notch Charpy Fracture Energy at -10°F

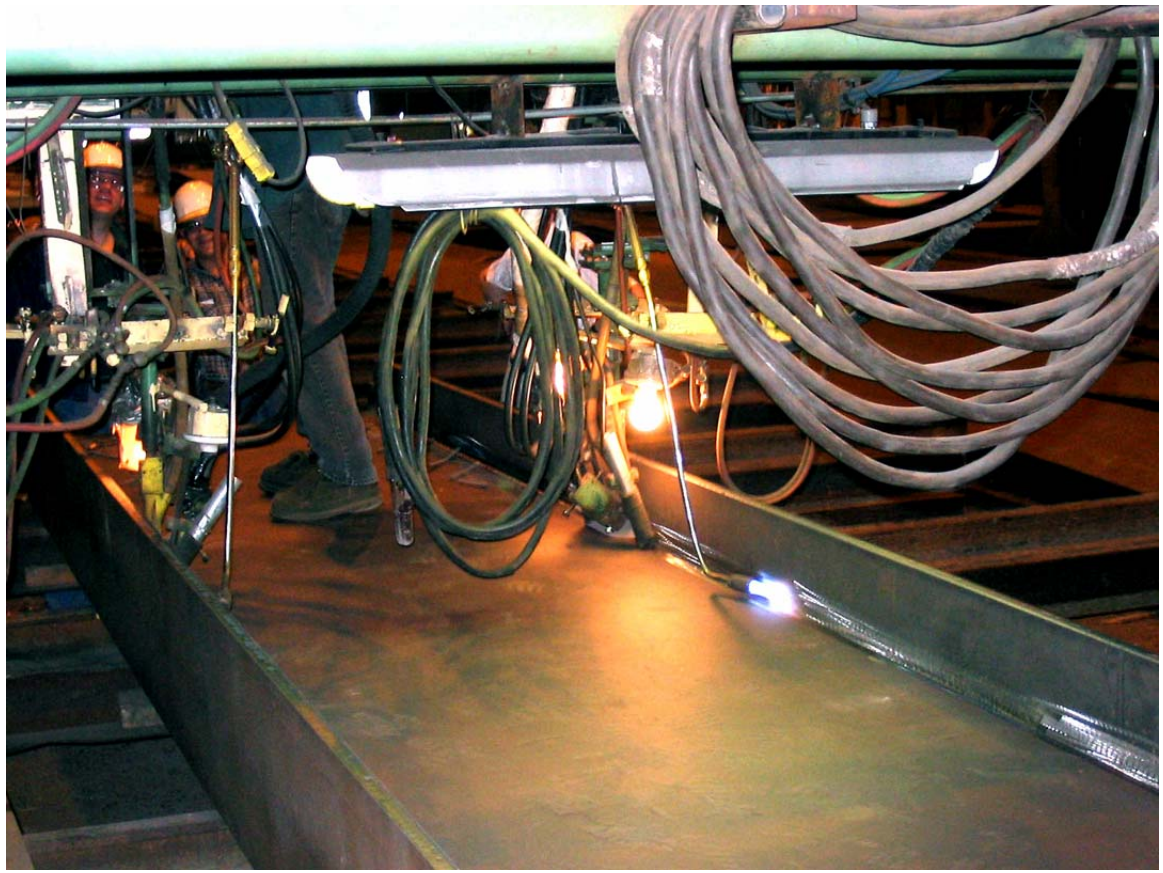


Effect of Heat-Straightening on Fracture Toughness

	Charpy (ft-lbs) at -10°F
As Received	169
Reheated at 800°F	165
Reheated at 950°F	155
Reheated at 1100°F	152
ASTM A710 Requirement	35

Industrial Steel Construction, Gary, Indiana


OGDEN
NGINEERING CORP. U.S.A.
LINCOLN




2

Second Part

Acknowledgement

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- Graef Schloemer and Assoc., Chicago
- ISG (now Mittal Steel) --- Alex Wilson
- Industrial Steel Construction, Gary, IN --- Chris Crosby
- IDOT --- Christopher Hahin
- Dunnet Bay Inc.

Super-Cryogenic-Tough NUCu-60 Steel

Yield (Ksi)	**60**
UTS (Ksi)	**80**
Elongation (%)	**27**

Temperature, ^{o}F	**Charpy Impact Energy Absorption (ft-lbs.)**
75	**>264**
10	**>264**
-40	**>264**
-80	**>264**
-110	**>264**