Oregon's First ASTM A 1010 Plate Girder Bridge

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Project Needs

Waterville Bridge

Fairview Road Bridge

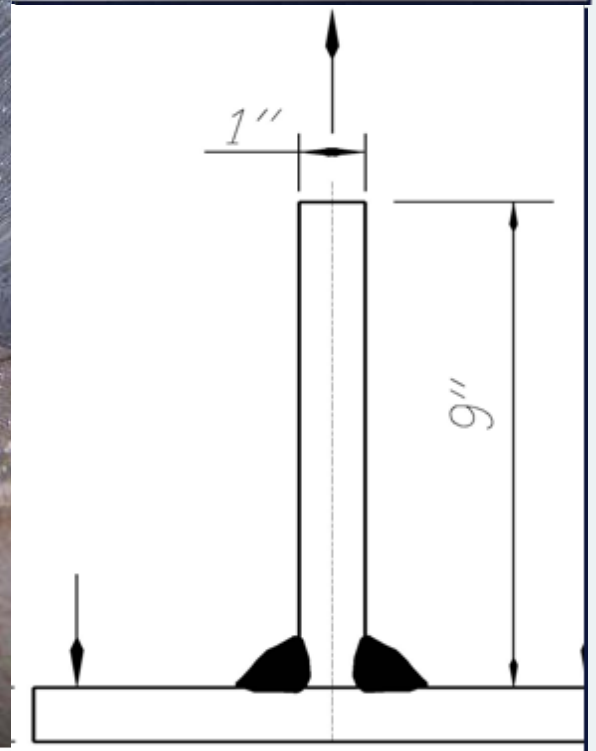
A1010 vs. A 572 Grade 50, A 588 & HPS 70W

- **Step 1 (Machinability)**
  - 15/16” dia. twist drill
  - Cut using band saw
  - Thermal Cut
- **Step 2 (Weld Feasibility)**
  - Full penetration groove weld
  - Filet weld
    - » Single pass
    - » Double pass
- **Accelerated Corrosion Test**

Drilling 15/16” dia. twist drill

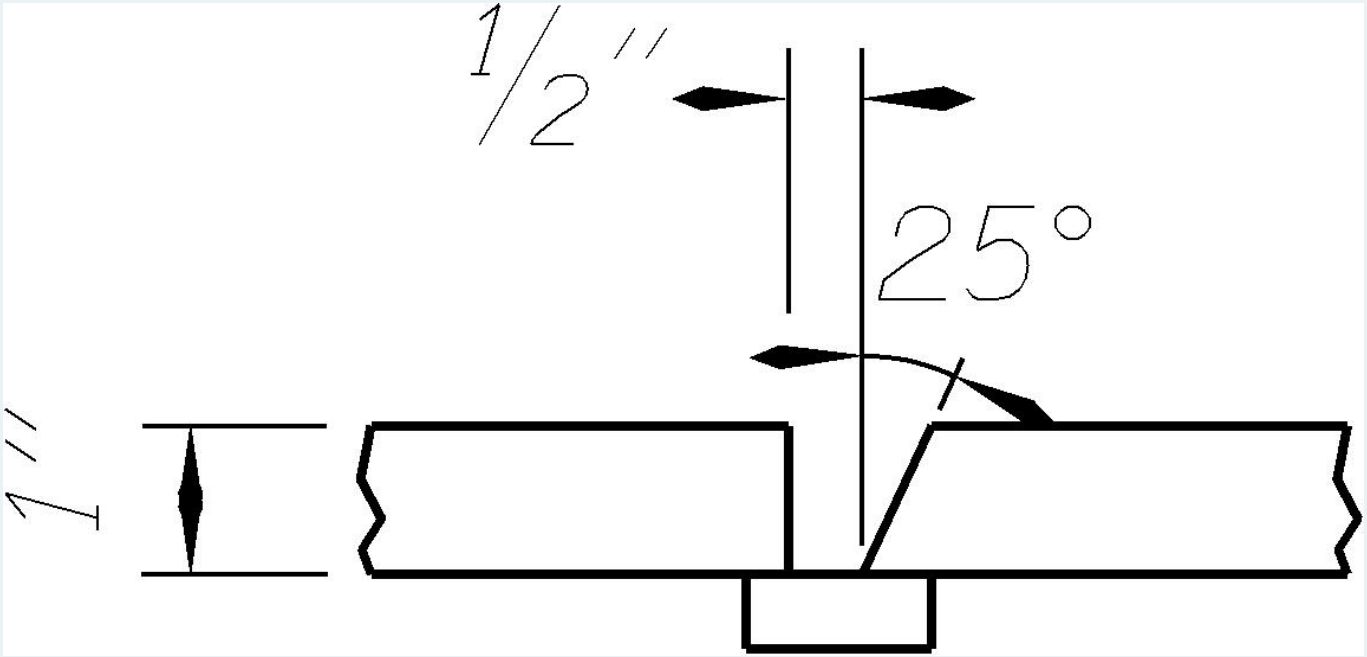
Filet Weld

- **FCAW single pass 5/16”**
- **SAW two pass weld 3/8”**



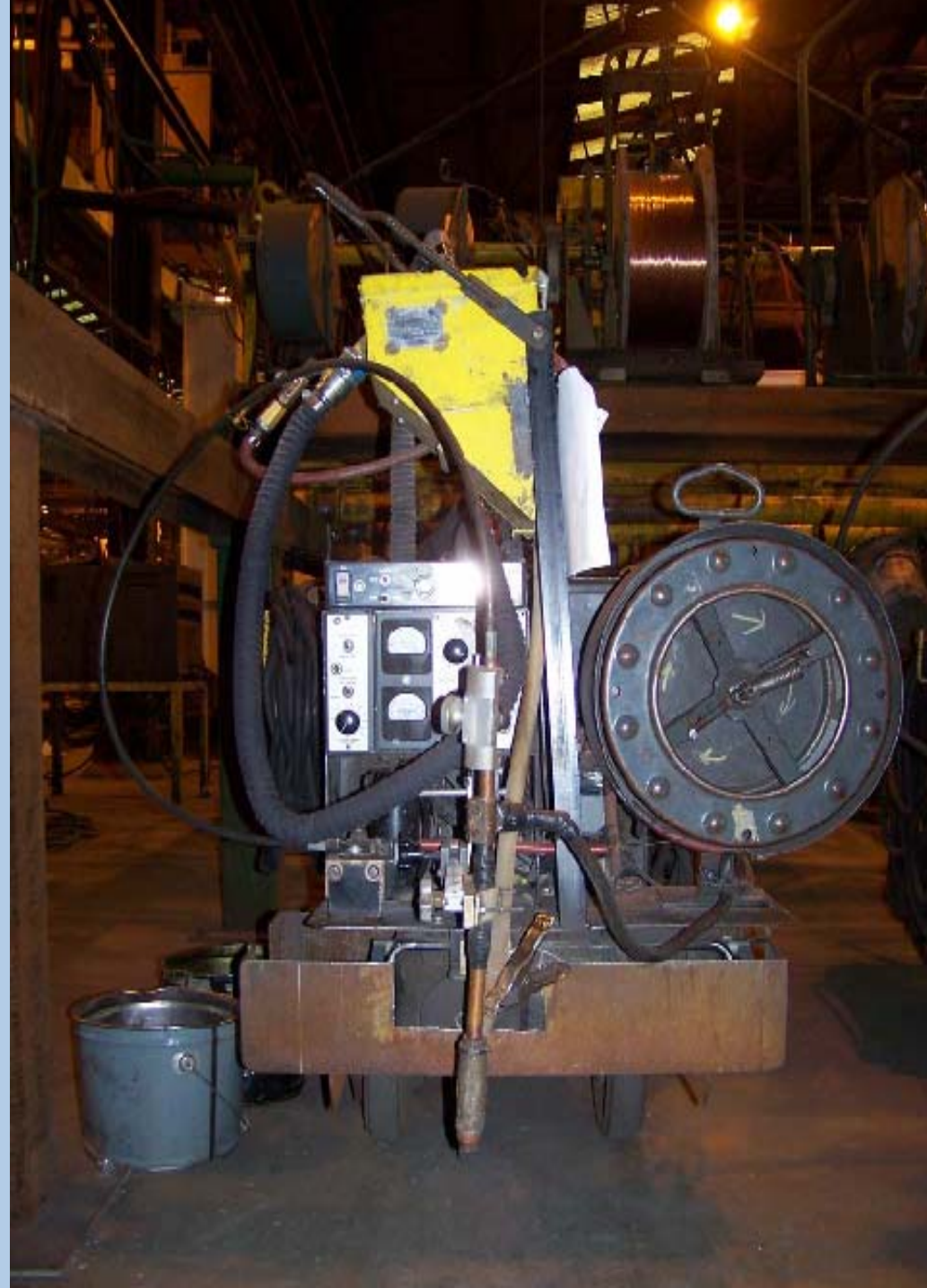
Weld parameters

- **Amps=450**
  Volts=34
  Travel=17 IPM
  Heat Input=54 kj
  Preheat=Ambient

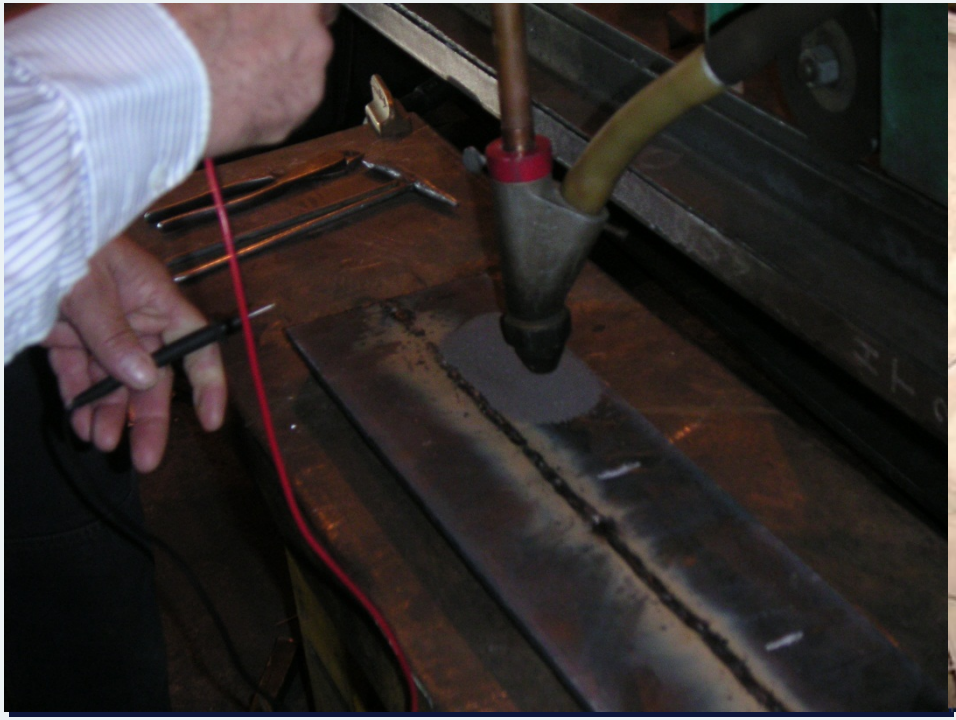


Welding Consumables

- **Lincoln Blue Max ER309L, 3/32” dia.**
- **Lincoln Blue Max 2000 Flux.**

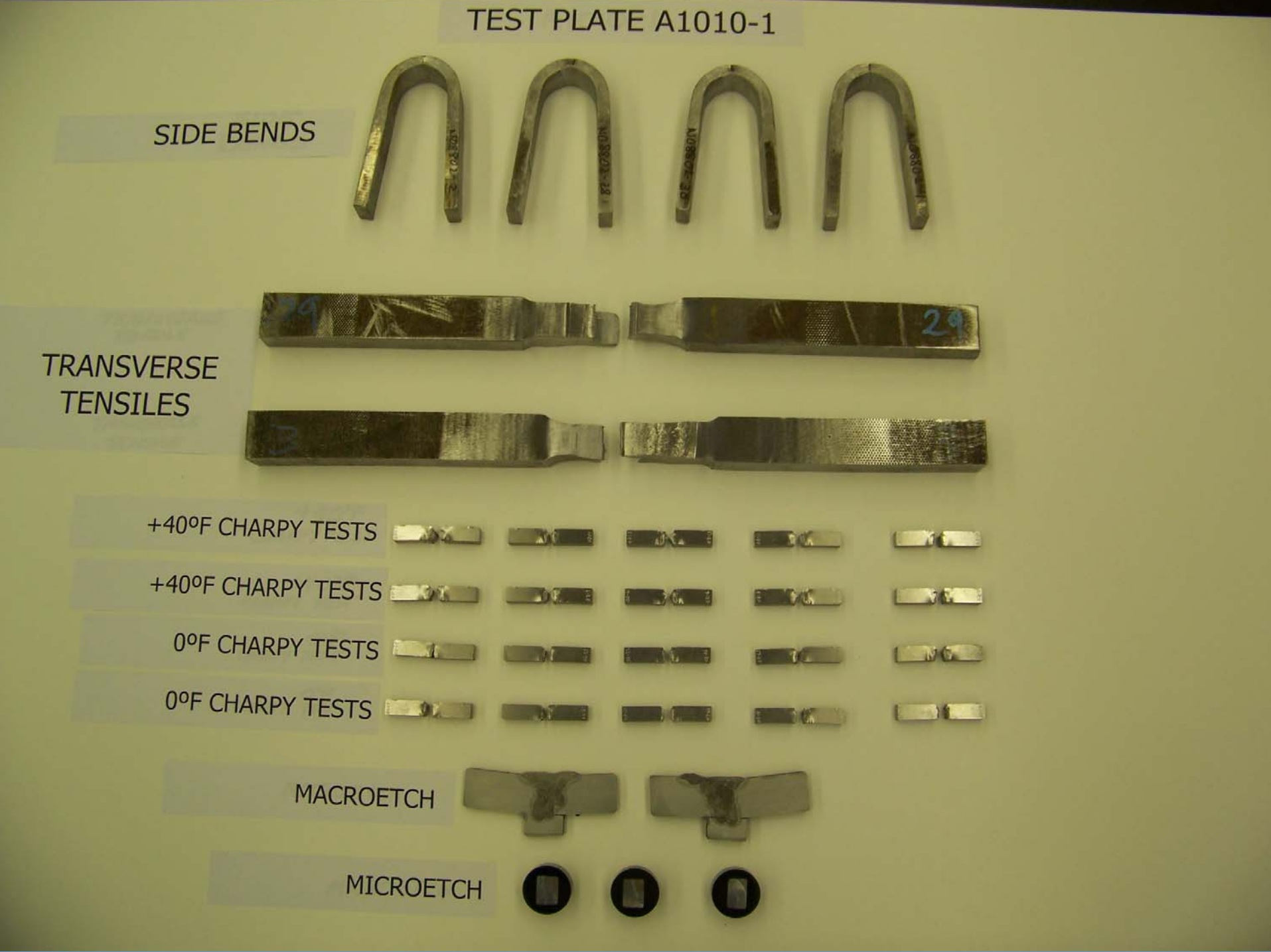


Heat input checked periodically



Distortion

TEST PLATE A1010-1



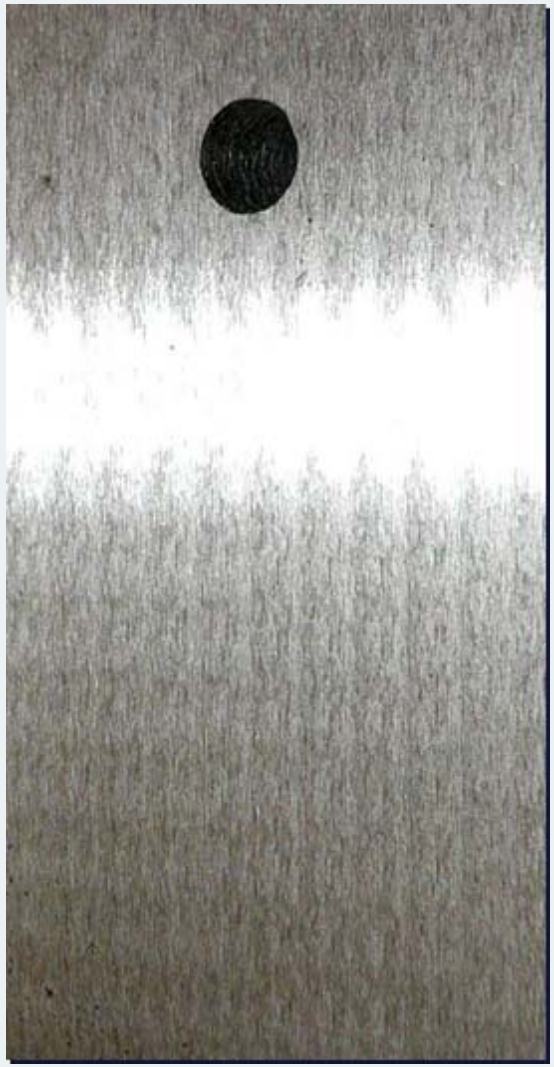
Distortion

Distortion

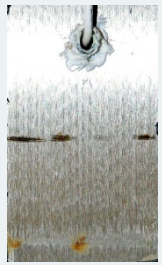
Corrosion Test Setup

Aggressive Corrosive Environment

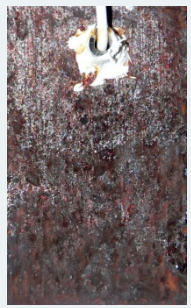
No environmental exposure



1 Year Exposure

A 588	HPS 70W	A 1010	A 1010 Weld
			

Fresh water exposure 4/day

Fresh water 4/day + salt water 2/week

Sealed container with water reservoir and salt spray 2/week

2 Years Exposure

A 588	HPS 70W	A 1010	A 1010 Weld
			

Fresh water exposure 4/day

Fresh water exposure 4/day and salt spray 2/week

Sealed container with water reservoir and salt spray 2/week

Finding

- **1998 ASTM recognized A 1010 with maximum plate thickness of 1”.**
- **A 1010 is Machinable**
  - Drilling
  - Saw cut
  - Thermal Cut.
- **A 1010 is weldable”**
  - ER309L, 3/32” consumable
  - Blue Max 2000 Flux
  - Distortion is almost twice of regular steel but can be controlled.

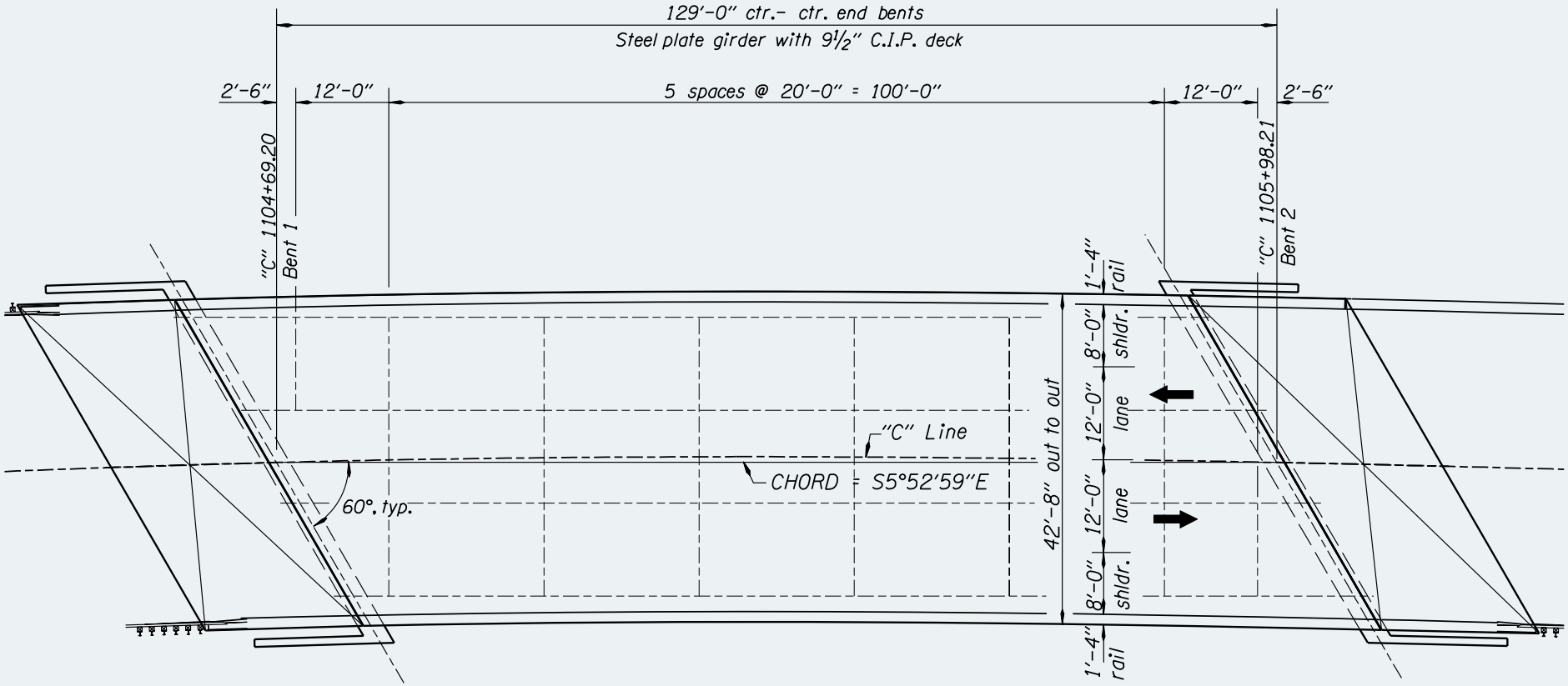
Finding

- **Full penetration groove weld with 55 kJ heat input and Interpass temperatures of 225 °F, 300 °F, 400 °F and 450 °F**
  - CVN test (performed for zone 2) met AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS requirements
  - No cracks observed in Side bend tests
  - All test samples surpassed the standard requirement set for tensile strength except for one sample at 300°F interpass temperature. However, it passed when the test was repeated.
  - Macro and Micro metallurgical samples indicated good fusion and grain structures.

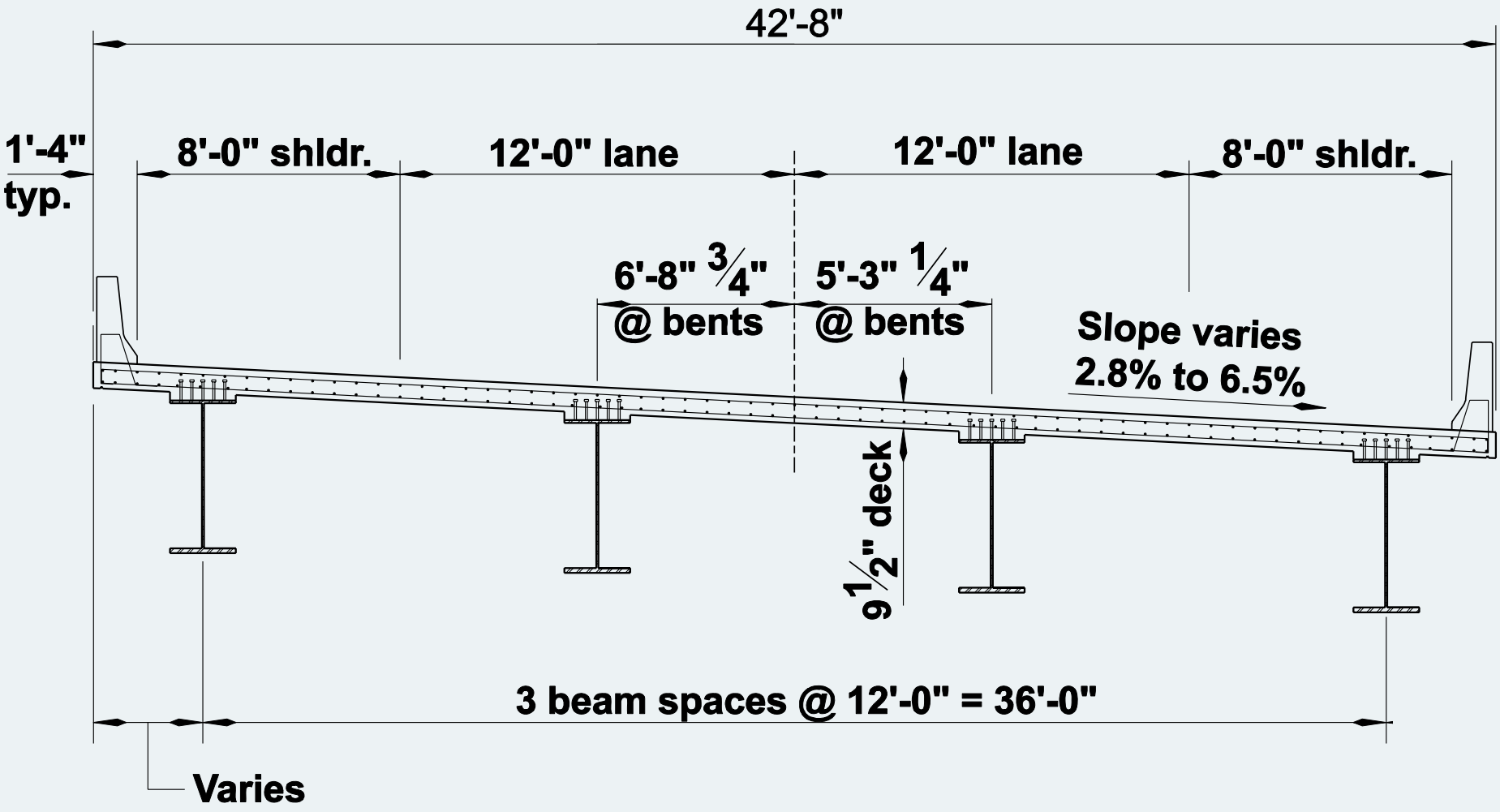
Finding

- **single and two pass fillet weld (automatic submerged arc and a semi-automatic flux core welding process) had ductile failure and fractured in the weld and the fracture path was through the weld metal as expected.**
- **$/lb (of A 1010) = (2 to 3) x $lb (of A 709 steel).**
- **Our study supported using ASTM A 1010 steel for bridge construction in mildly salty and humid environments. It has shown to have more resistance to corrosion than weathering steel or high performance steel.**

Dodge Creek Bridge



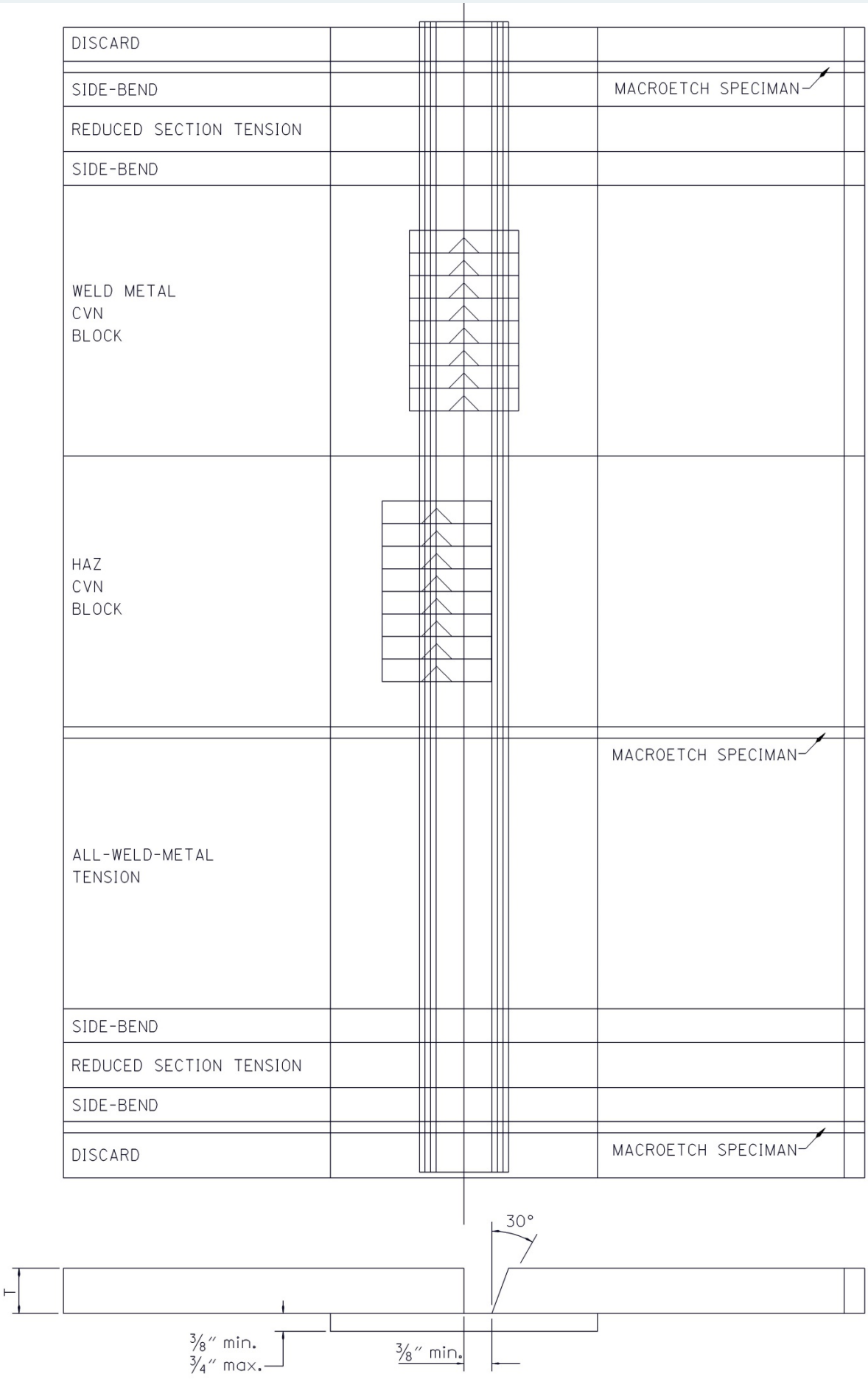
Dodge Creek Bridge



Special Provisions

- **Check samples from both end of each**
  - CVN meets A 709 HPS Grade 50W zone 2 for fracture critical bridges
  - Yield strength 50 ksi
  - Tensile strength 70 ksi
  - Welder…….
  - PQR

PQR


DISCARD
SIDE-BEND
MACROETCH SPECIMAN
REDUCED SECTION TENSION
SIDE-BEND
WELD METAL
CVN
BLOCK
HAZ
CVN
BLOCK
MACROETCH SPECIMAN
ALL-WELD-METAL
TENSION
SIDE-BEND
REDUCED SECTION TENSION
SIDE-BEND
DISCARD
MACROETCH SPECIMAN
30°
T
3/8" min.
3/4" max.
3/8" min.

Observed Cracks

Special Provisions