ASTMA 1010
BRIDGES

Hormoz Seradj, P.E.
Steel Bridge Standards Engineer

2014 Annual Meeting of The
AASHTO Subcommittee on
Bridges and Structures

T-14: AASHTO Technical
Committee for Structural Steel
Design
June 16, 2014
- 0.160” thick plate
- Press brake formed into cells
- Welded together in modules
PROJECT NEEDS

Waterville Bridge

Fairview Road Bridge
LITERATURE SEARCH

- **ASTM A1010**
  - **Grade 40**  
    - $F_y = 40$ ksi
  - **Grade 50**  
    - $F_y = 50$ ksi
  - **Thickness**  
    - 1 in. Max.

- **Steel Mills**
  - **Width**  
    - 130 in. Max.
  - **Length**  
    - 540 in. Max.
  - **Thickness**  
    - 2.0 in. Max.
Heat inputs ranged from 25 kJ/in to 70 kJ/in with the latter an input commonly used for joining thicker plate.

Lincoln Blue Max, ER309L, 3/32” dia.

Thermal parameters

Flux baked at 400 °F, 8 hour minimum, unused flux recovered and rebaked for reuse

Preheat temperature: Sufficient to remove surface moisture

Interpass temperature: 210-225 °F
A1010 VS. A 572 GRADE 50, A 588 & HPS 70W

- Accelerated Corrosion Test
- Machinability
- Weld Feasibility
### 2 YEARS EXPOSURE

- **ASTM A 1010** can be used 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.

<table>
<thead>
<tr>
<th>A 588</th>
<th>HPS 70W</th>
<th>A 1010</th>
</tr>
</thead>
</table>

- **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
IS ASTM A 1010 MACHINABLE?

- Drilling
- Saw cut
- Thermal Cut
MACHINABILITY: A1010 VS. A 572 GRADE 50

- Drilling 15/16” dia. twist drill

- Cut using band saw
Thermal Cut, Plasma
IS ASTM A 1010 WELDABLE?
WELD PARAMETERS & CONSUMABLE

- Amps=450
- Volts=34
- Travel=17 IPM
- Heat Input=54 kJ/in
- Preheat=Ambient

- Lincoln Blue Max ER309L, 3/32” dia.
- Lincoln Blue Max 2000 Flux.
# DESIGN AND FABRICATION SPECIFICATIONS

## PQR

<table>
<thead>
<tr>
<th>Macroetch Specimen</th>
<th>Discard</th>
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</thead>
<tbody>
<tr>
<td>Reduced Section Tension</td>
<td>Discard</td>
</tr>
<tr>
<td>Side-Bend</td>
<td>WELD Metal CVN Block</td>
</tr>
<tr>
<td>HAZ CVN Block</td>
<td>Reduced Section Tension</td>
</tr>
<tr>
<td>ALL-WELD-METAL TENSION</td>
<td>HAZ CVN Block</td>
</tr>
<tr>
<td>Side-Bend</td>
<td>Discard</td>
</tr>
</tbody>
</table>

![Diagram](image.png)
SAW TEST RESULTS

- Full penetration groove weld with 55 kJ heat input and Interpass temperatures of 225 °F, 300 °F, 400 °F and 450 °F
FILET WELD TEST RESULTS

- FCAW single pass 5/16”
- SAW two pass weld 3/8”
DODGE CREEK BRIDGE
SHOP ASSEMBLING
AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.

Permit truck loading.
OREGON’S SINGLE PERMIT TRUCKS

STP-5BW 204k 9-axel vehicle

STP-4E 258k 13-axel vehicle
AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

- Permit truck loading.
- Yield strength 50 ksi.
- Tensile strength 70 ksi.
FABRICATION SPECIFICATIONS

- Welding Procedure Specifications
  - Procedure Qualification Record (PQR),
  - Welder,
  - Ultrasonic inspection,
  - New tools.
FABRICATION SPECIFICATIONS

- CVN meets A 709 Grade HPS 50W for zone 2 fracture critical bridges,
- Check Samples from each end of each plate.
DODGE CREEK BRIDGE

42'-8"

1'-4" typ.

8'-0" shldr.

12'-0" lane

12'-0" lane

8'-0" shldr.

6'-8 3/4"
@ bents

5'-3 1/4"
@ bents

9 1/2" deck

3 beam spaces @ 12'-0" = 36'-0"

Slope varies 2.8% to 6.5%
DODGE CREEK BRIDGE

129'-0" ctr.- ctr. end bents
Steel plate girder with 9½" C.I.P. deck

5 spaces @ 20'-0" = 100'-0"

2'-6"
12'-0"

Bent 1

"C" Line

CHORD 55°52'59"E

Bent 2

48'-8" don't to det

8'-0" shldr. lane

8'-0" shldr. rail

60°, typ.
FABRICATION PROBLEM

CVN

ft-lb @ 10 °F

Plate thickness, in
OBSERVED CRACKS
Charpy V-notch Test Results

Energy ft-lbs 30 @ 10°F

Minimum required CVN for HPS Grade 50W for FCM

PLATE THICKNESS INCH

0.75
1
1.25
1.5
1.75

0
30
60
90
120
150
180
210
240
270
Charpy V-notch Test Results

Minimum required CVN for HPS Grade 50W for FCM

Plate Thickness, Inch

Energy ft-lb @ 10°F

MILL CREEK BRIDGE
MILL CREEK BRIDGE
### LINEAR REGRESSION EQUATIONS FOR THICKNESS LOSS IN 5% NAACL CYCLIC CORROSION TESTS.

<table>
<thead>
<tr>
<th>Steel</th>
<th>Coefficient Mill per Cycle</th>
<th>Predicted Life VS ASTM A 588</th>
</tr>
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<tbody>
<tr>
<td>ASTM A 1010</td>
<td>0.050</td>
<td>10.40</td>
</tr>
<tr>
<td>11Cr</td>
<td>0.056</td>
<td>9.30</td>
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<tr>
<td>9Cr</td>
<td>0.147</td>
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<tr>
<td>9Cr2Si</td>
<td>0.197</td>
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<tr>
<td>7Cr2Si</td>
<td>0.304</td>
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<td>7Cr2Al</td>
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<tr>
<td>7Cr2Si2Al</td>
<td>0.275</td>
<td>1.90</td>
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<tr>
<td>ASTM A 588</td>
<td>0.519</td>
<td>1.00</td>
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Publication: FHWA-HRT-11-061, July 2011
Steel Bridge Design Handbook: Bridge Steels and Their Mechanical Properties

Publication No. FHWA-IF-12-052 - Vol. 1

November 2012