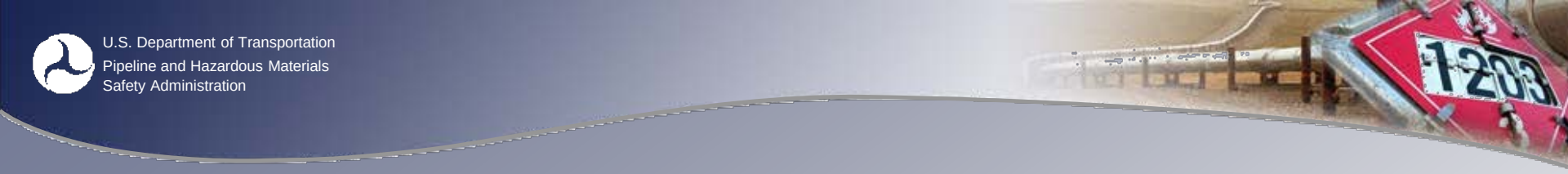
U.S. Department of Transportation
Pipeline and Hazardous Materials
Safety Administration



Challenges with Field Girth Welding

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Know what's below.
Call before you dig.

Recent Girth Weld Incidents

Interactive Girth Weld Threat

Girth Welds with
Low Tensile Strain Capacity

+

High Axial Tensile Strain

Girth Welds with Low Tensile Strain Capacity

- Recent incidents:
  - High weld misalignment
  - Poor weld quality
  - Pre-existing hydrogen-assisted WM/HAZ cracks
  - Evidence of little or no plastic deformation
- Codes have no requirement for girth weld tensile strain capacity

PHMSA Advisory Bulletin

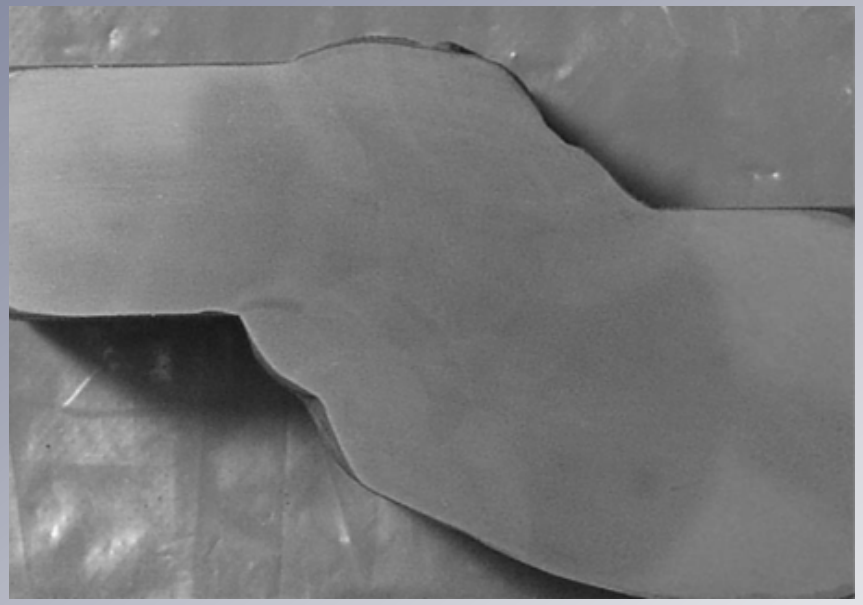
- ADB-10-03 (Mar 24, 2010) Girth weld quality issues due to improper transitioning, misalignment, and welding practices of large diameter linepipe

http://www.phmsa.dot.gov/pipeline/regs/advisory-bulletin

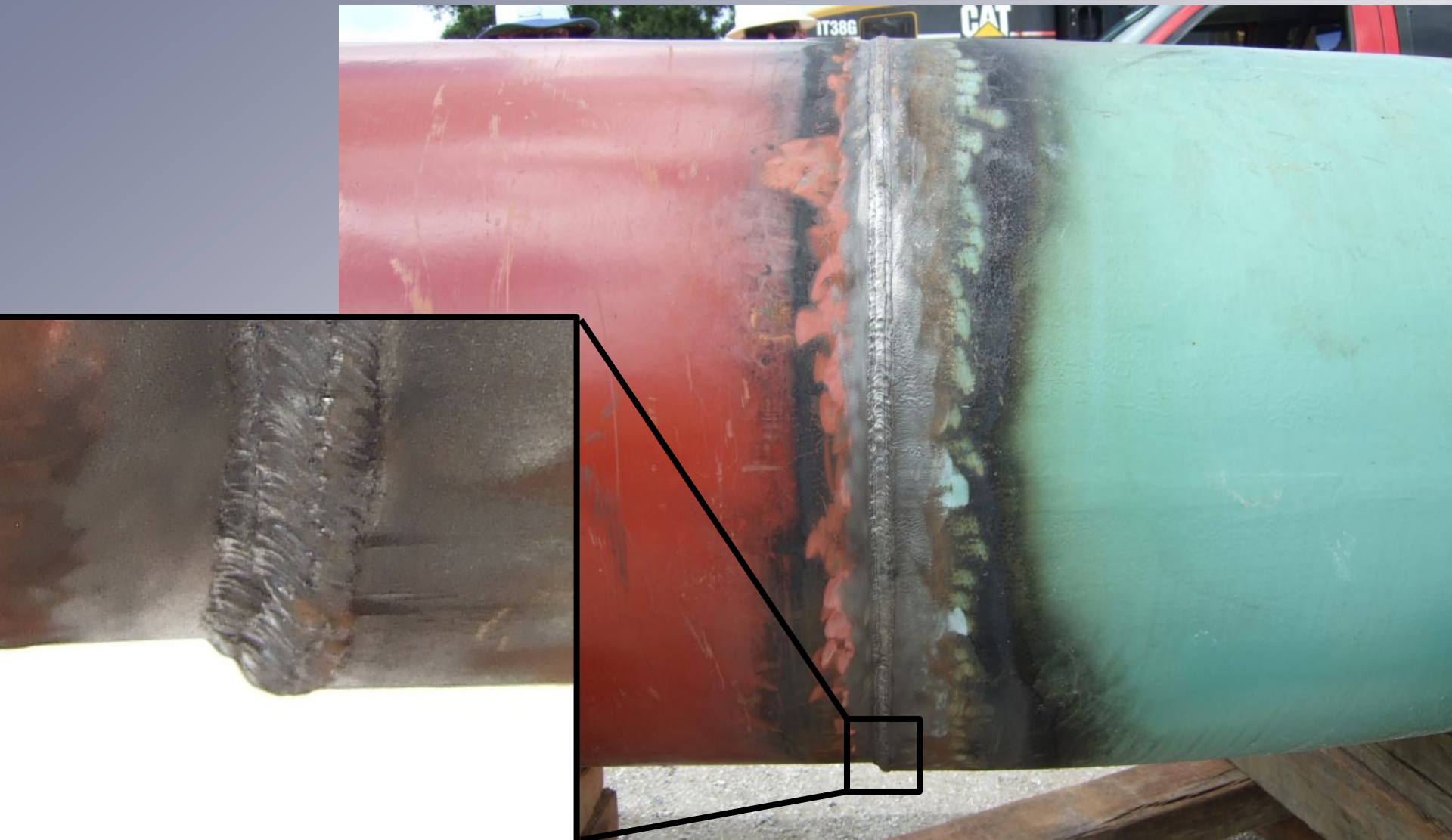
In-service Failure

- Below in-service failure of 42” X70 gas transmission pipeline at 1200 psi (65% SMYS)

Misalignment

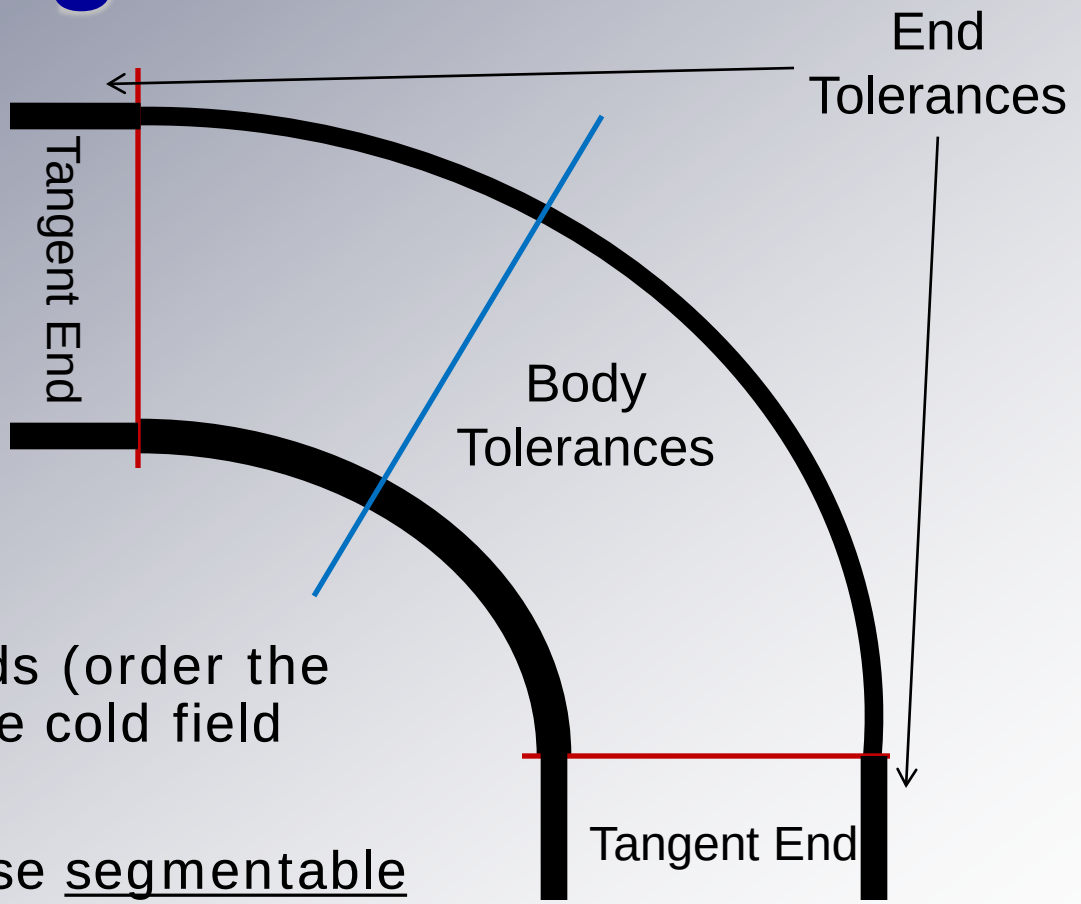


Misalignment at Segmented Bend



Segmenting Induction Bends

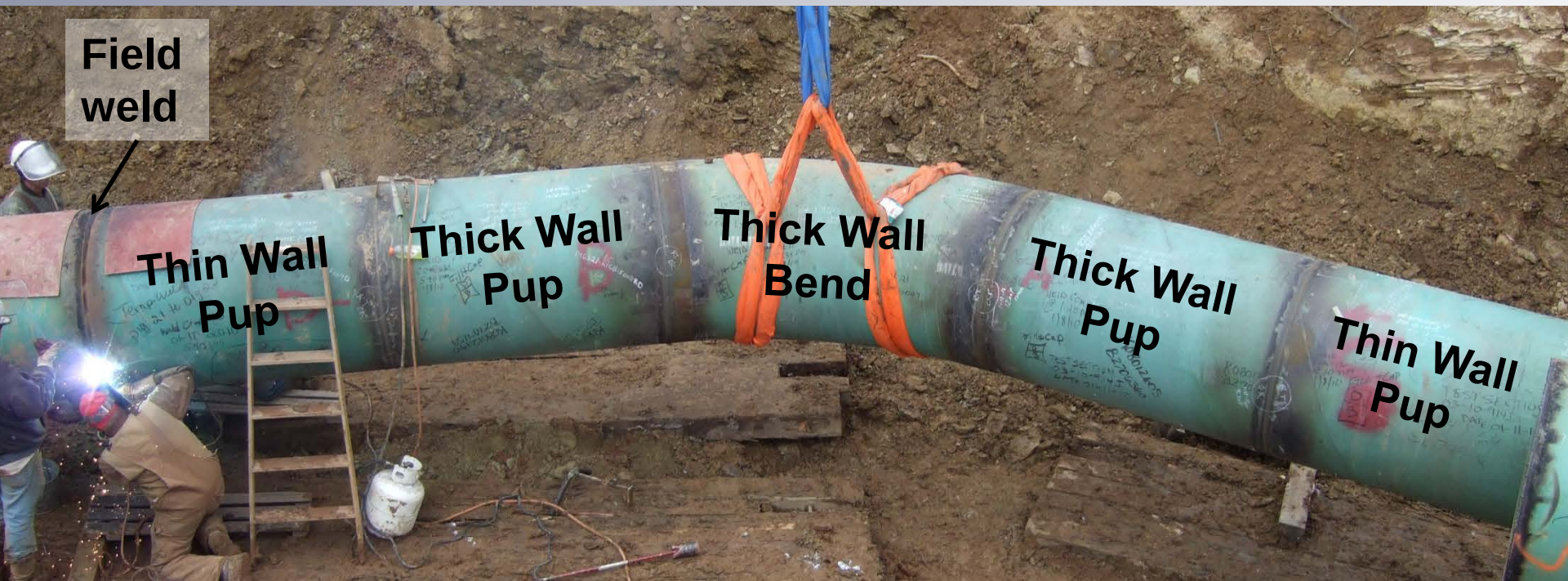
Cross-section of Induction Bend



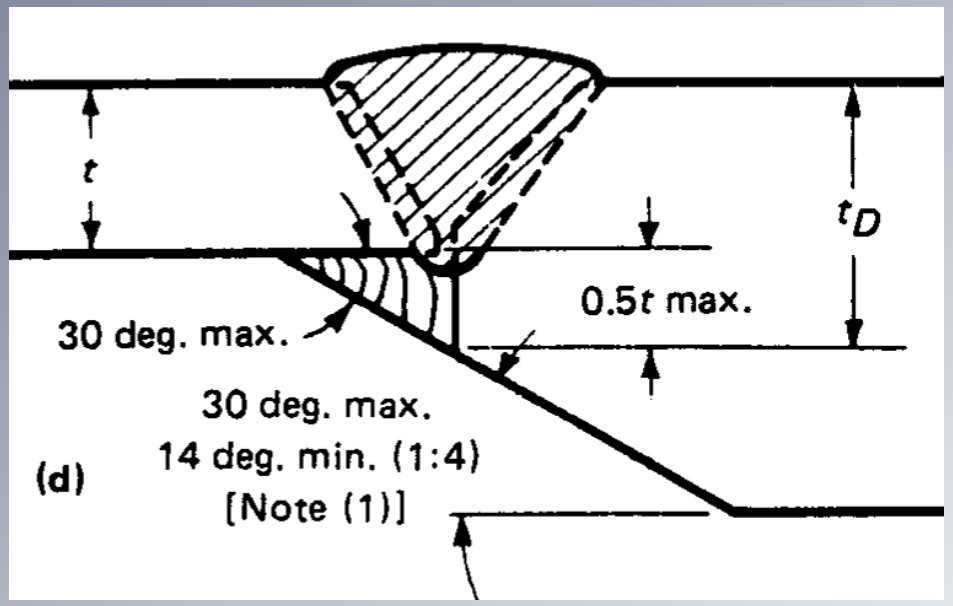
- Avoid segmenting bends (order the exact bend angle or use cold field bends when possible)
- When cutting bends, use segmentable bends with tighter body tolerances, confirm acceptable end dimensions, and use transition pipe pups

Shop fabricated bend assembly

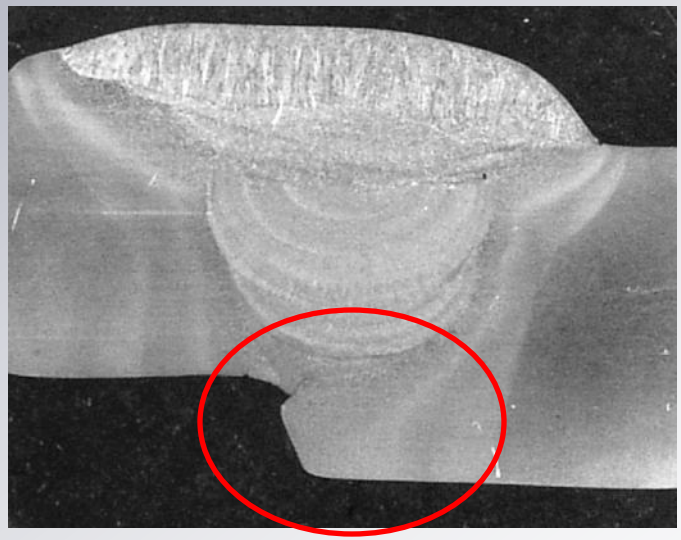
- "Difficult welds" (thickness transitions and backwelding) to pipe pups are made in a fabrication shop/yard
- "Easy welds" (straight pipe of the same wall thickness) are made in the field
- Ensure adequate pup length and support

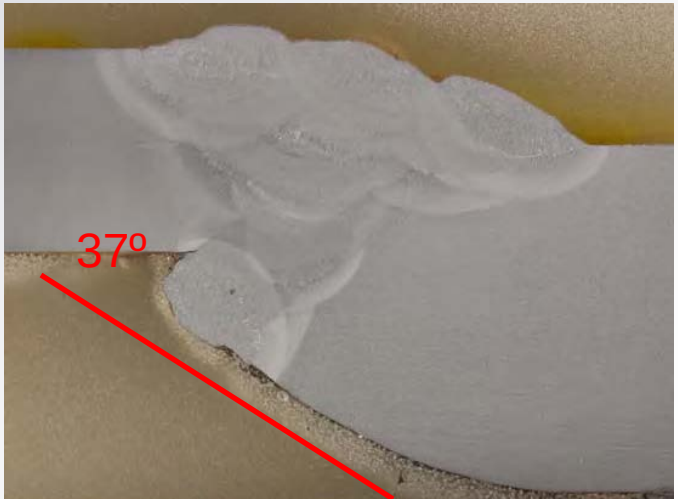


Improper Weld Transitions



ASME B31.8 Fig. I-5





Backweld Quality

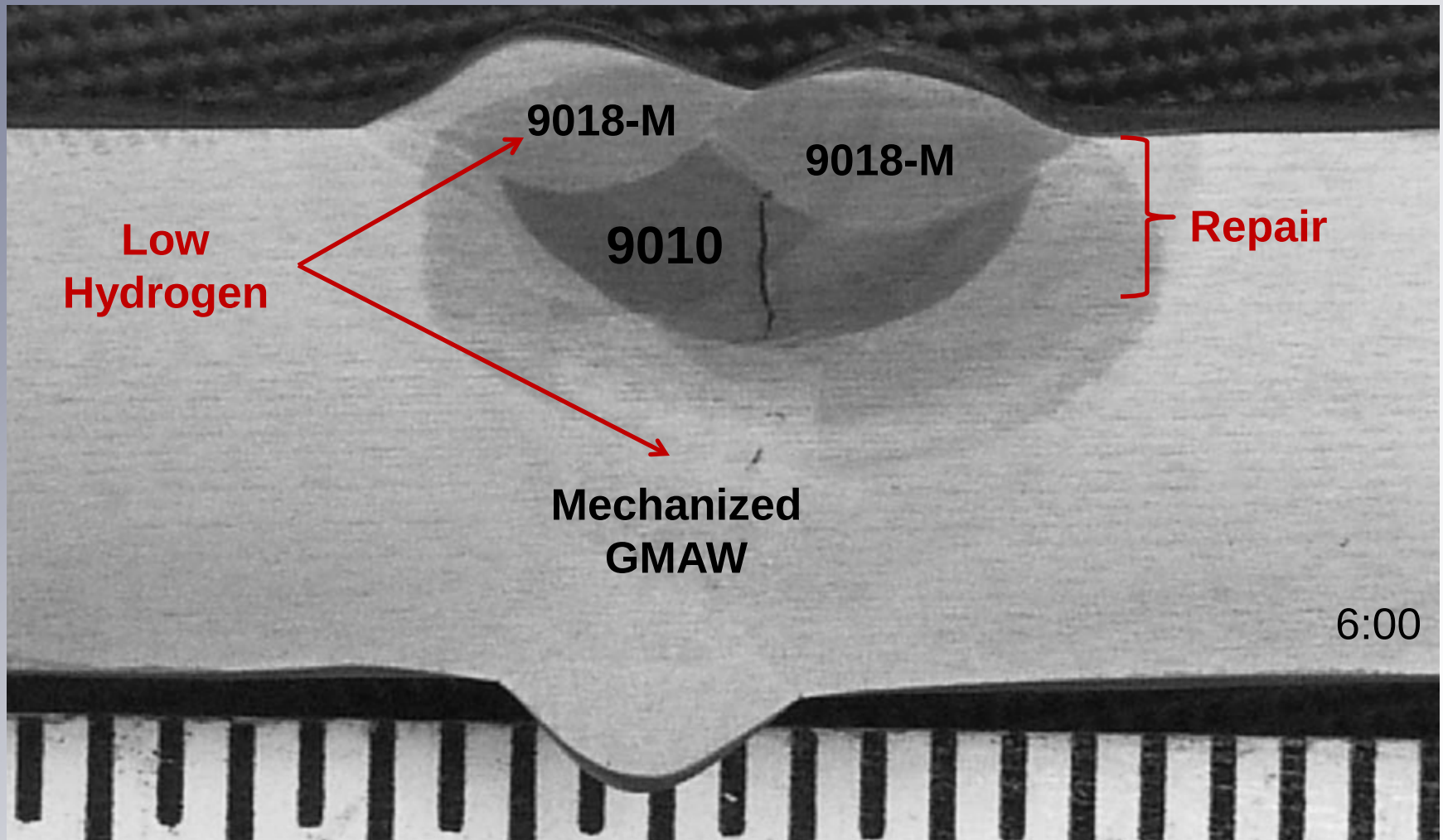
- Difficult to weld
- Difficult to inspect
- Highly stressed
- Bead shape is critical to minimize stress concentration

Welding Segmented Induction Bends

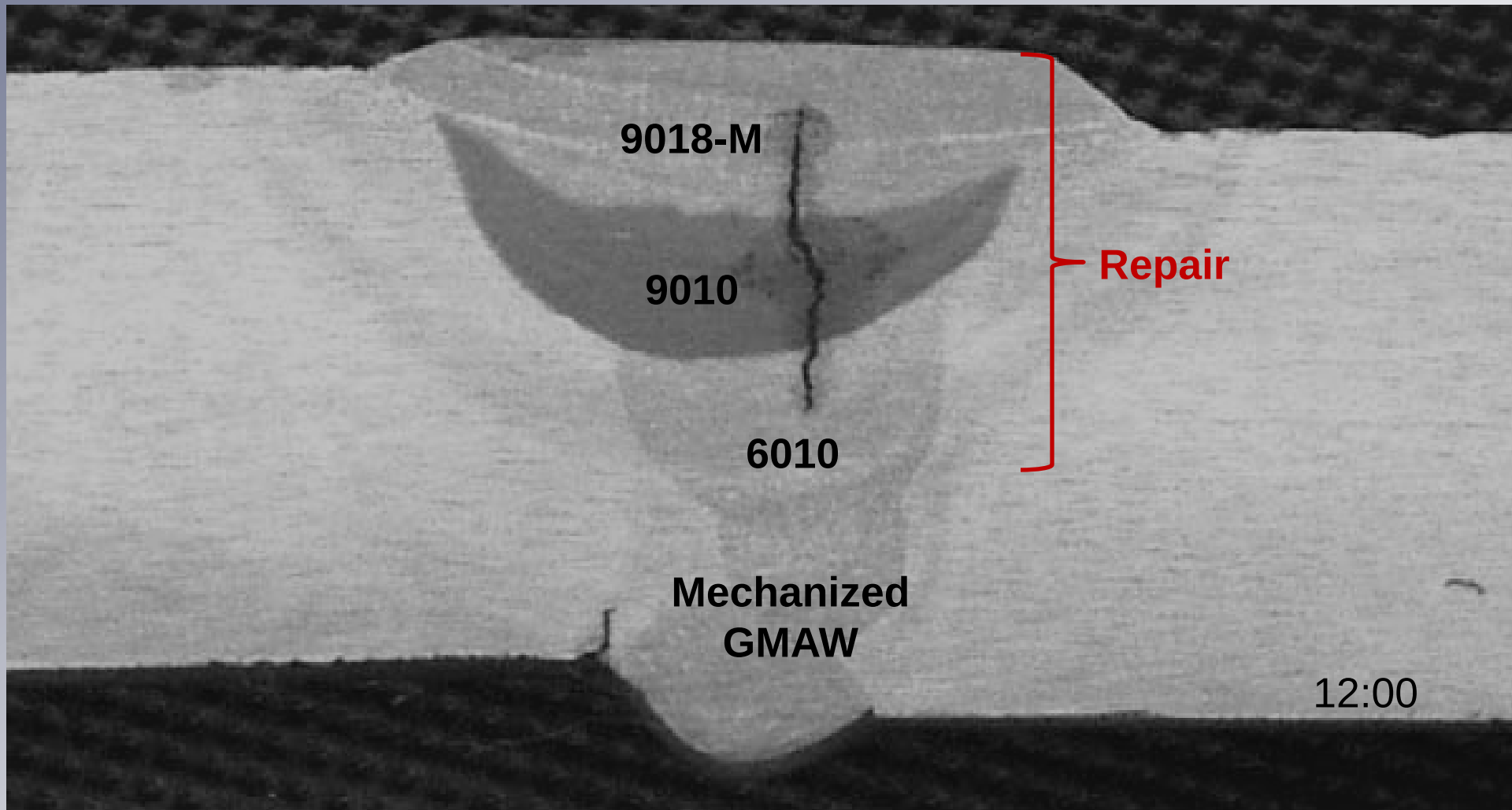
- Joint Industry Project (JIP) on Welding of Segmented Induction Bends
  - DNV Columbus, P-PIC, 9 pipeline operators
  - Develop guidance for field construction practices and purchase specification of segmentable bends

Hydrogen Assisted Cracking (HAC)

HAC: One cellulosic weld pass



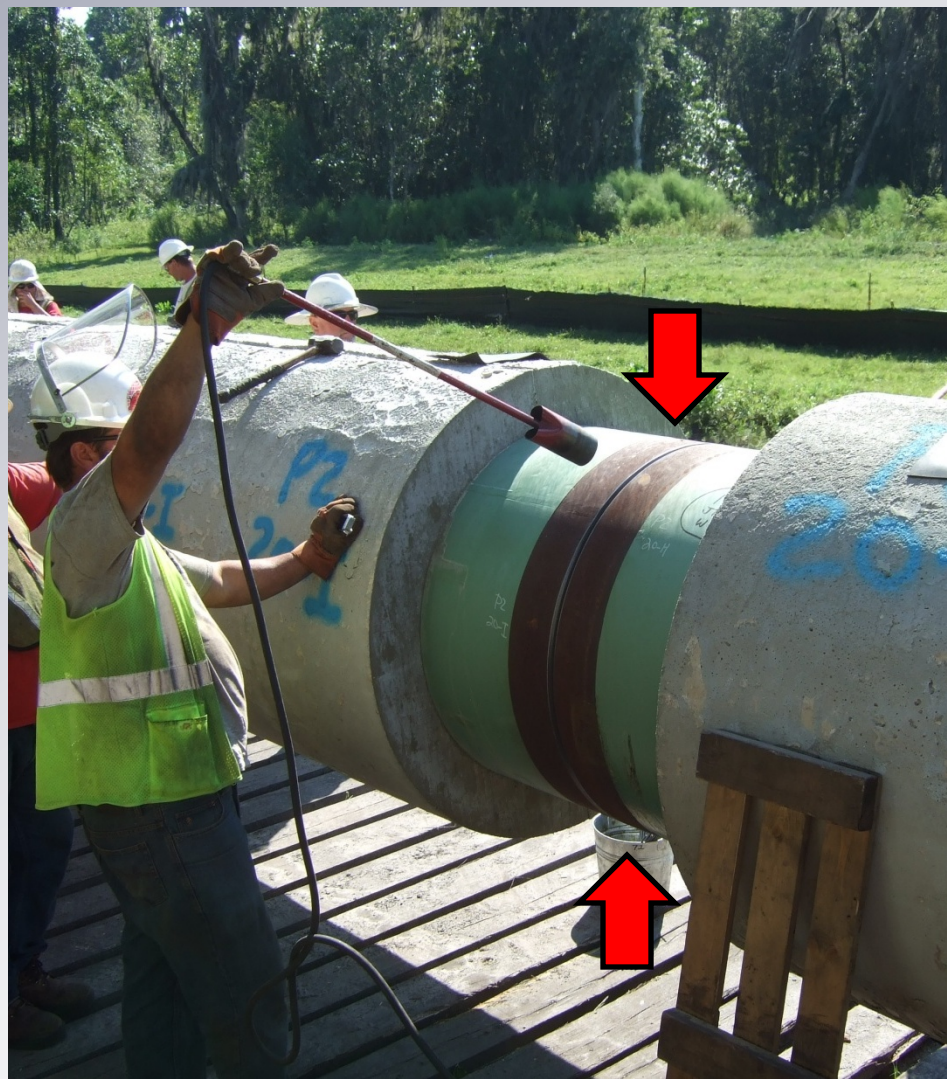
HAC: Weld Repair



HAC: Flux-cored Weld

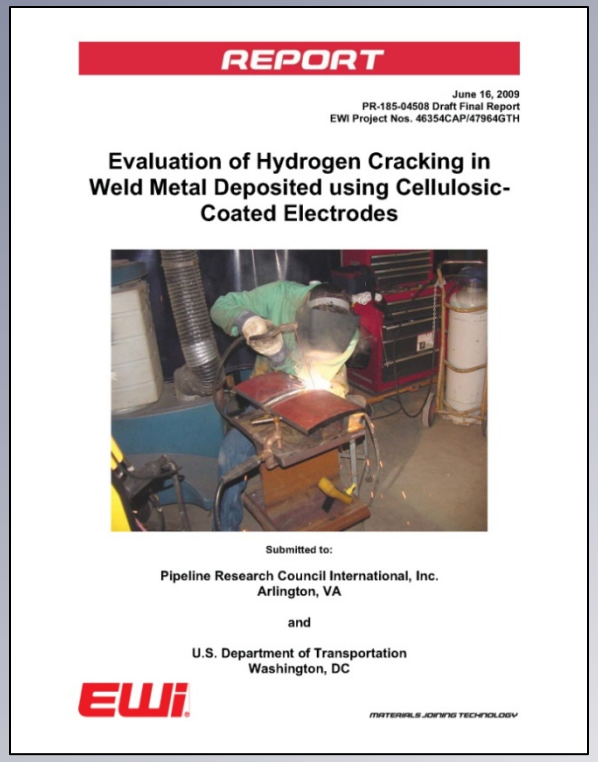
Proper Weld Preheat is Critical

- Heat **entire** circumference, especially the **top** and **bottom** of the pipe



Avoid Dry Cellulosic Electrodes

Increases Mn, Si



REPORT

June 16, 2009
PR-185-04508 Draft Final Report
EWI Project Nos. 46354CAP/47964GTH

Evaluation of Hydrogen Cracking in Weld Metal Deposited using Cellulosic-Coated Electrodes

Submitted to:

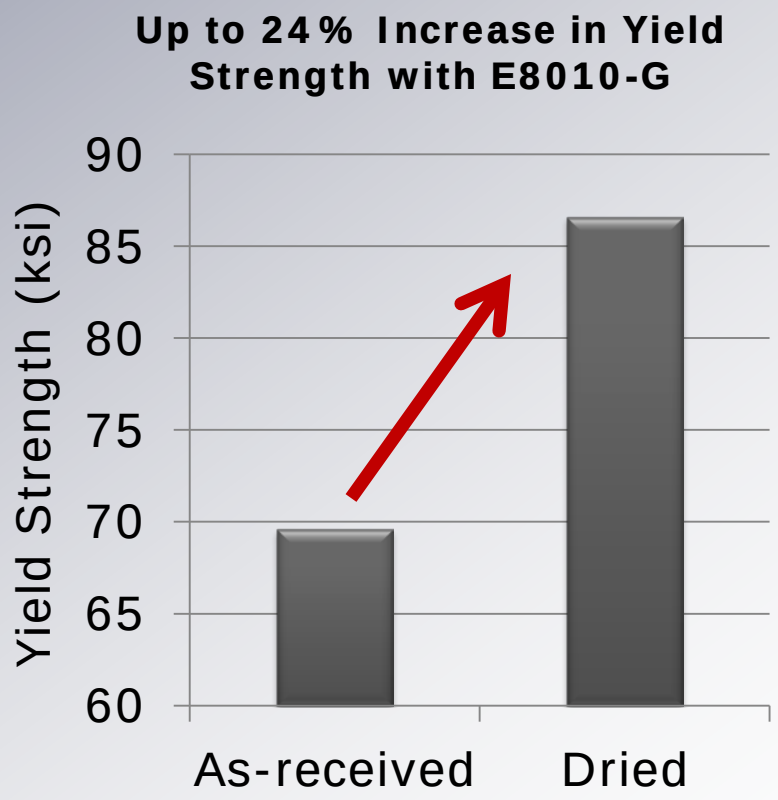
Pipeline Research Council International, Inc.
Arlington, VA

and

U.S. Department of Transportation
Washington, DC

EWI

MATERIALS JOINING TECHNOLOGY



http://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=144

Lowering In Stress

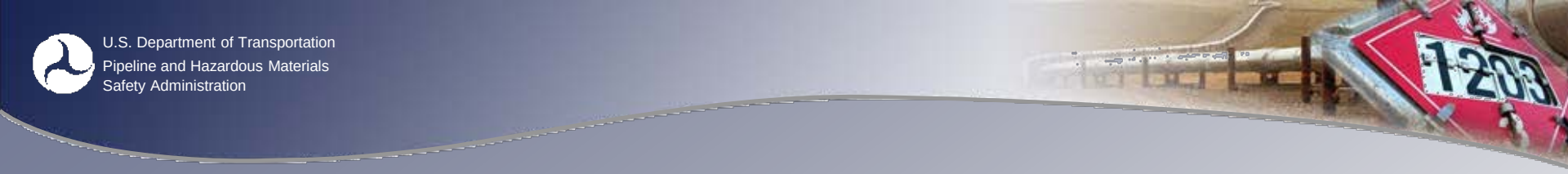
- Maximum weld stress occurs during lowering in
- Most weld failures at top & bottom of pipe

Low Strength Fittings

Hydrotest failure at 80% of test pressure

Low Strength Fittings

Coating cracks from expansion of fitting during hydrotest



Thank you

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