HEAT STRAIGHTENING OF A DAMAGED BOTTOM FLANGE

NBPP 2019 MEETING
BURLINGTON, VT
Timothy Boodey, P.E. NHDOT

New Hampshire DOT
Department of Transportation

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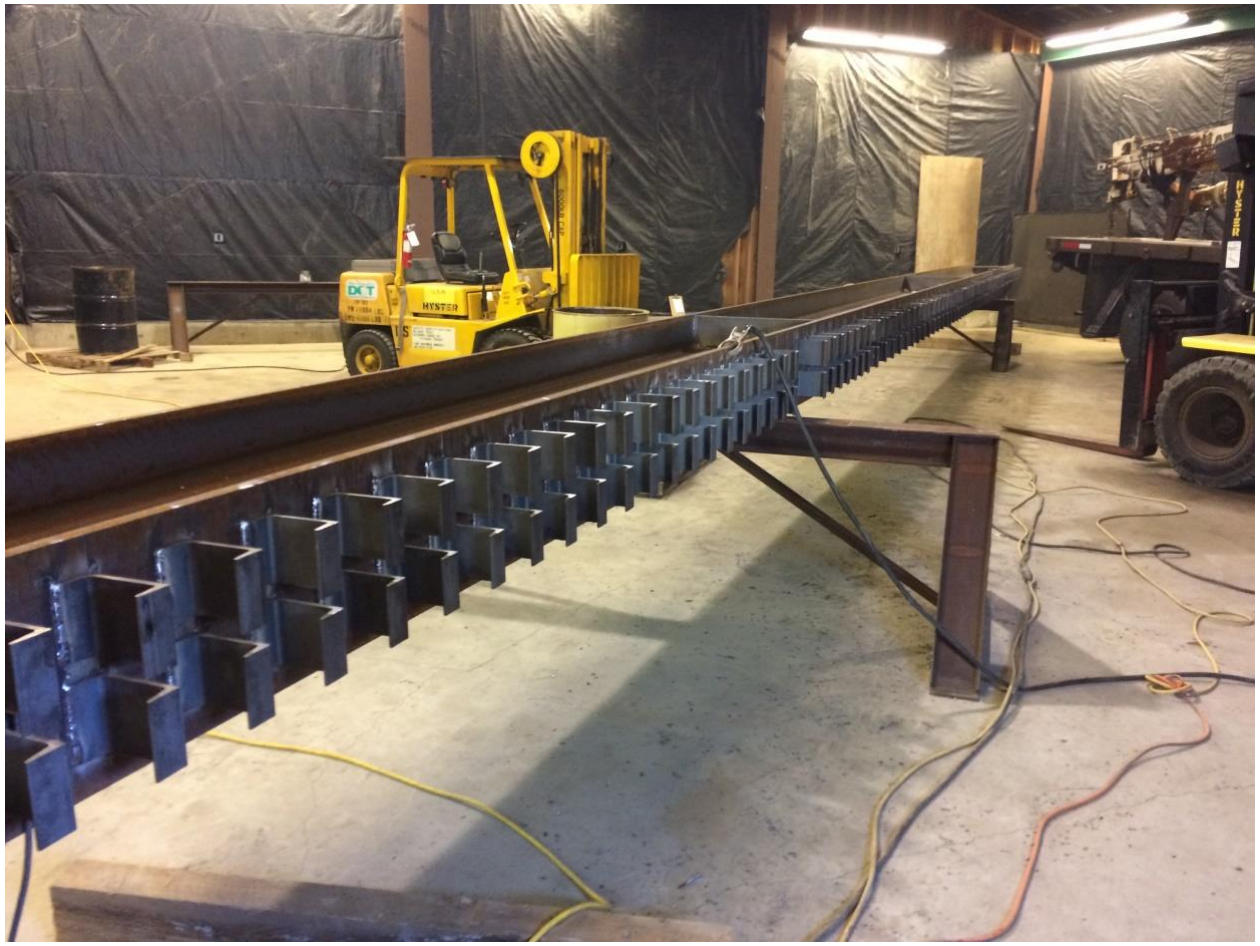

The use of heat and/or jacking has been used to for decades to repair distortions caused by welding, install camber in bridge girders, and induce horizontal curves in bridge girders.

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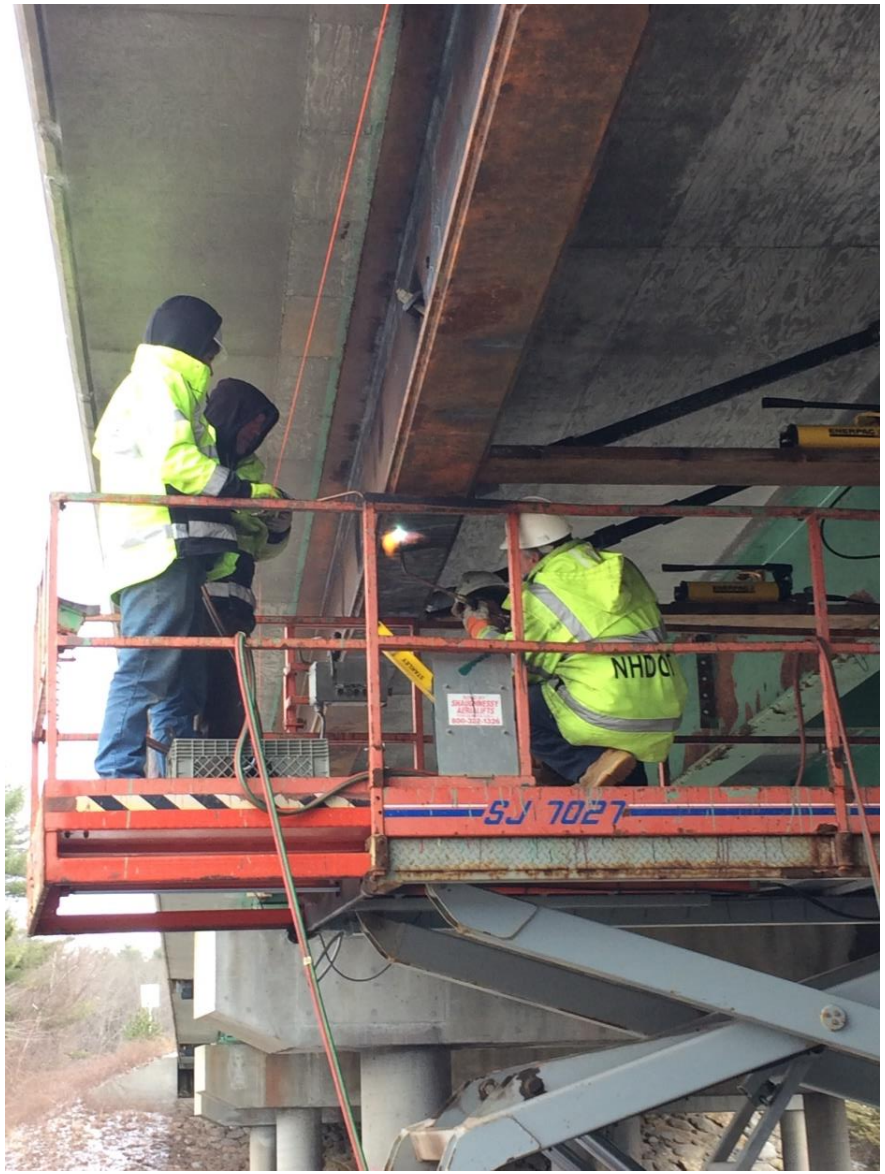

Heat-straightening is a repair technique conducted in the field for steel that has been damaged, and portions have exceeded the yield stress

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Relies on

- **controlling the maximum temperature applied**
- **controlling the external restraints**
- **only working the plastically deformed zones**
- **In a series of heating and cooling cycles**

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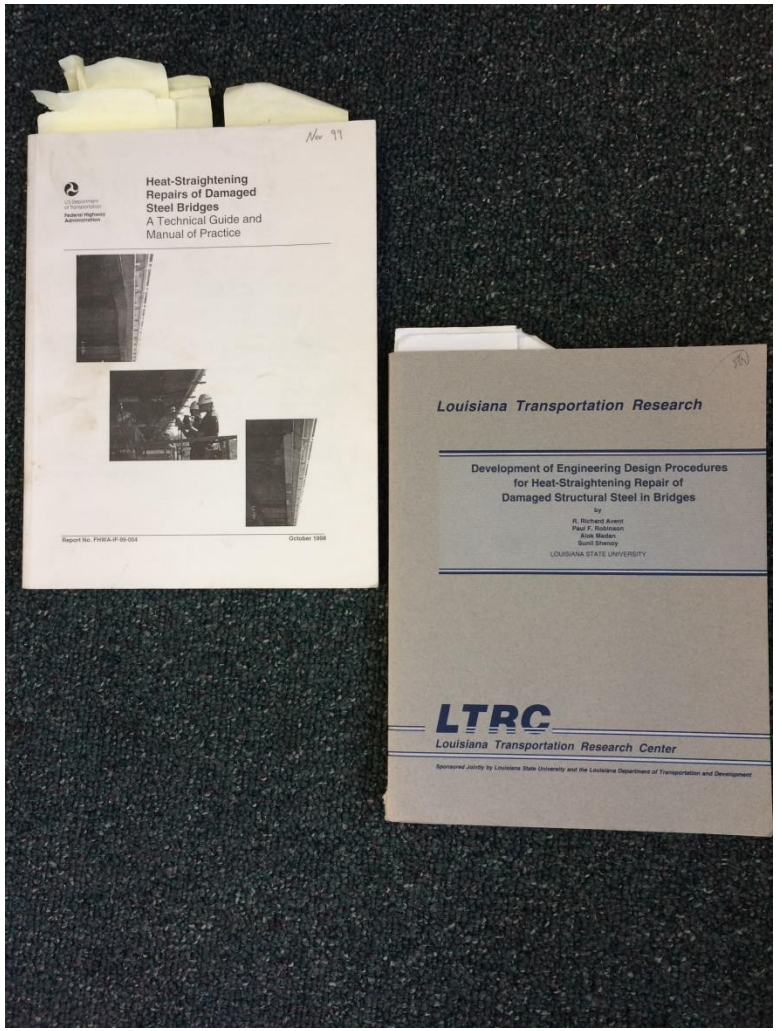
Use FHWA Report FHWA-IF-99-004 Heat-Straightening Repairs of Damaged Steel Bridges.

Largely based and informed by research from the Louisiana State University sponsored by the Louisiana Department of Transportation.



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- **Heat-Straightening can be used to effectively repair damaged steel providing science behind the art**

- **Mechanical properties of the steel are unimpaired under proper quality control**

- **Jacking or restraining forces can be used if controlled**

- **Heat straightening should be limited to two similar repairs on the same location**

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Temperature Control

- Torch size and speed
- Temperature gun
- Temperature crayons
- Heat patterns

Control restraining force

- Look at the section trying to affect
- What is load to produce appropriate force
- Apply force to area of ram head

Area of deformed zone

String line, straight edges

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Project Considerations

A lot depends on the location of the damage and what the access is, traffic volume and impact.

Consider worker access and safety – paint removal, man lifts, fall protection, respirator protection, open torches

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Dover 084/165

NH 16,Sp Tpk over Long Hill Road

Three Span continuous I-BC built 1956

Vertical clearance 13”-9’

2/6/2015 Accident occurred
2/19/2015 Notified of accident

Damage to Girder 14, span 2 (32’), ~18” horizontal displacement, lower flange rotation, puncture

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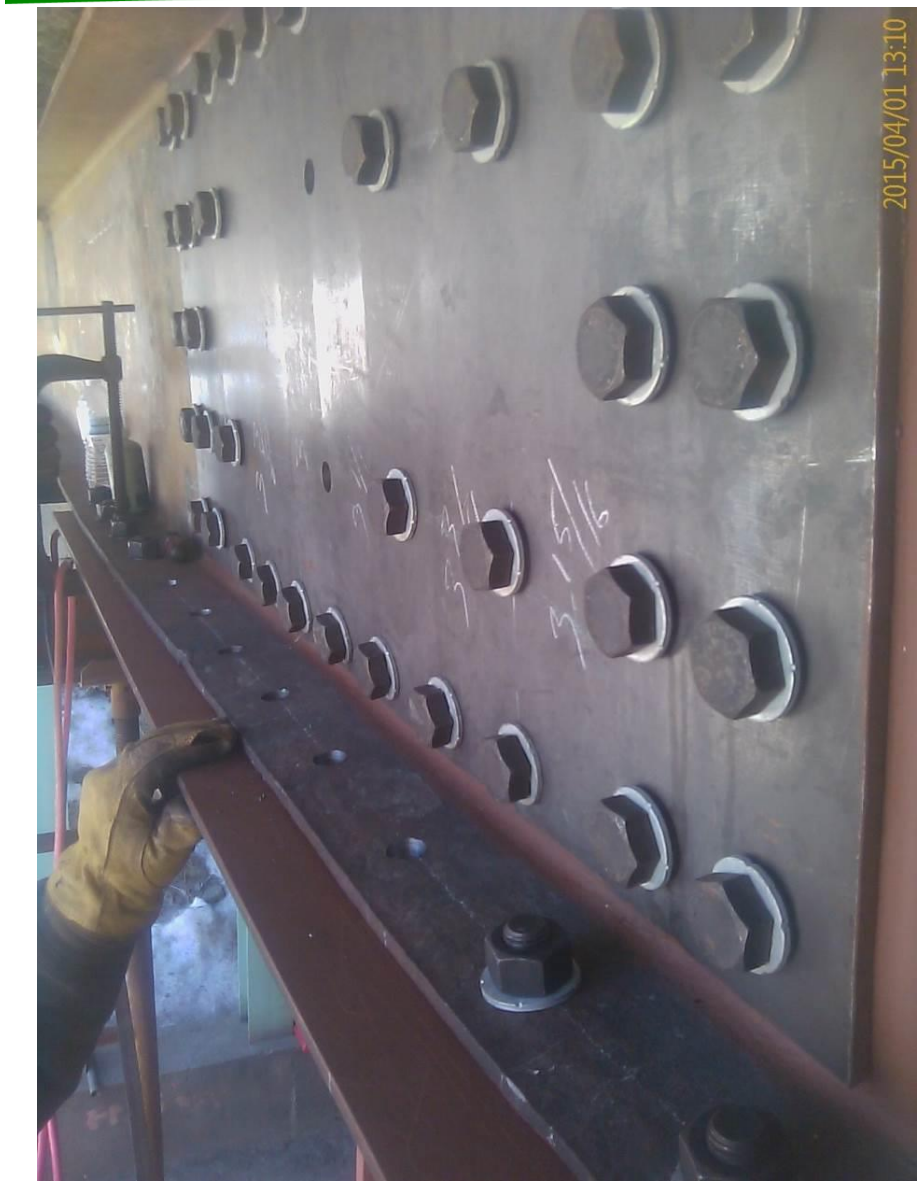

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NH 16,Sp Tpk over Long Hill Road

2/19/2015 Notified of accident

3/3/15 Work Started

4/10/15 Work Finished

19 working days for all work using daytime road closures
(3 days paint removal, 9 days heat straightening)

Total project cost of $120,000

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Concord 041/123
US 4 over I-93 (Exit 17 SB)

5 Simple Span I-BC built in 1958

Vertical clearance of 16’-4”

3/14/2019 Accident occurred

Damage to Girder 8, Span 4, ~11.5” horizontal displacement, puncture

Three vehicles involved, three persons injured.

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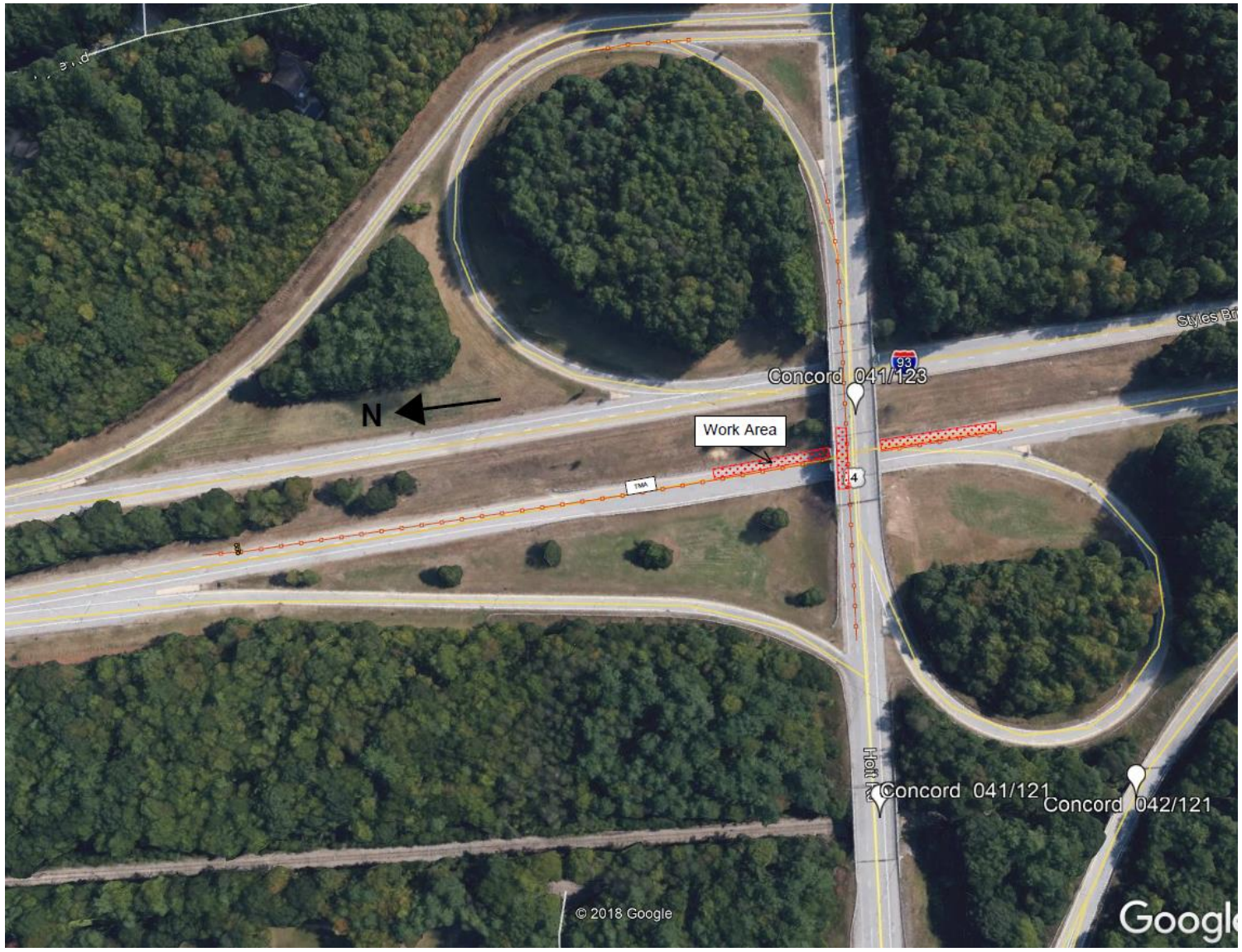

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3/14/2019 Notified of accident

3/26/15 Work Started

5/2/15 Work Finished

25 working days for all work using daytime road closures
(4 days paint removal, 15 days heat straightening)

Total project cost of $70,000

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Other Notes

We tend to be conservative with restraining force, do not do very often and almost every time with a new crew

Can be slow, seems like it stops, keep at it, literature suggests may be working through residual stresses from the impact

There are often punctures or tears associated with over height damage that necessitates a designed, detailed and bolted web and/or flange plates

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Other Notes

Have materials ready particularly gasses for your torches.

In addition to vee heats, Crews tend to use spot heats rather than longer line heats.

Have trouble with getting bulges out

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Thank you

Questions?

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