Maintenance Steel Repairs
Doug F. Rose, P.E. and John J. Picard, P.E.

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Maintenance Steel Repairs

..... are a WIN – WIN situation.
BRIDGE INSPECTION, INVENTORY AND LOAD RATING
New York State Department Of Transportation
STRUCTURES DIVISION

TECHNICAL ADVISORY

ISSUED BY:
STRUCTURES DIVISION
BRIDGE INSPECTION UNIT

SUBJECT:
BRIDGE INSPECTION GUIDELINES
FOR INSPECTION IN THE BEARING
AREAS OF CORRODED PRIMARY
MEMBERS

DATE:
Feb. 9, 2006

APPROVED BY:
Deputy Chief Engineer (Structures)

SUPERSEDES:
None

None
Beam End Deterioration
Beam End Deterioration
Past NYSDOT Repairs
Beam End Deterioration - Solutions

- “T” Beam repair
- Double angles
- Install 3x5 Tubes
NY240 / Cazenovia Creek
NY240 / Cazenovia Creek

**Location:** Town of Colden - BIN 1042510

**Nature of Failure (NOF):** Floorbeam Deterioration

**Nature of Response (NOR):** NYSDOT Personnel installed temporary repairs (5 locations) to keep structure open till scheduled letting and award (~ 4 months)
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Past NYSDOT Repairs

<<insert pics – text to describe pictures>>
NY240 / Cazenovia Creek

<< COSTS >>

Labor - 700 man hours (17 days)

Materials – Steel Cover Plates ................ $8000.00

Misc hardware (nuts and bolts, etc.) ... $845.00
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BIN 6001320 NY 5& 20 over Cattaraugus Creek

3 – 180 ft spans

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Past NYSDOT Repairs
Maintenance Steel Repairs

Past NYSDOT Repairs
Maintenance Steel Repairs

NY 5/20 Cattauragus Creek
Maintenance Steel Repairs

Past NYSDOT Repairs
Maintenance Steel Repairs

Past NYSDOT Repairs
Maintenance Steel Repairs

Pedestrian Bridge over NY33 – BIN 1071980

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NEW YORK STATE

STEEL CONSTRUCTION MANUAL
3RD EDITION

DAVID A. PATERSON
GOVERNOR

ASTRID C. GLYNN
COMMISSIONER

DEPARTMENT OF TRANSPORTATION, OFFICE OF STRUCTURES
MARCH 2008

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The Steel Construction Manual (SCM) has been prepared in an effort to produce a single source document to describe minimum requirements for the preparation of fabrication drawings, ordering and receipt of materials, fabrication by welding and bolting, transportation, erection, repair, rehabilitation, and testing and inspection of structural metals. The 3rd Edition of the SCM contains extensive revisions to reflect changes in design and technology since the last publication of this document.

**Revision:** March 2008, 3rd Edition

**History:** Issued 1973, Revised twice, last in 1984

**Contact:** Metals Engineering *(518) 457-4528*

**Available At:** Plan Sale *(518) 457-2124*
What are the Requirements …

>> Licensed Professional Engineer

>> Certified Welder

>> Access Equipment

>> Jacking Equipment

• What’s helpful …

>> Crew with Steelworker/Millwright experience
Licensed Professional Engineer

Services provided ...

>> Evaluation of Flagged Condition

>> Development of repair details

>> Development of jacking plan

>> Preparation and submittal of shop drawings

>> Preparation of Welding Procedure Specification (WPS)

>> Professional Engineering Certification
Certified Welder

>> NYS Certification required

>> Field Welder Information
www.nysdot.gov/divisions/engineering/structures/....
.... engineering/approved-field-welder-list

>> FIELD WELDER QUALIFICATION PROCESS
www.nysdot.gov/.../page/portal/divisions/engineering/structures/...
.... repository/files/FW_Brochure_4-07_0.pdf - 2008-08-23

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Access Equipment
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>> Scaffold

>> Manlift

>> UBIU

>> Other Specialized Equipment
Maintenance Steel Repairs

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What’s the Process …

>> Receive Structural Flag requiring steel work

>> Determine options
   - Close
   - Operate at reduced loading/traffic
   - Repair

>> Develop Repair Detail and WPS in Consultation

>> Execute repairs with Certified Welder, as req
Welding Procedure Specification (WPS)
Common Steel repairs
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Radio of weld access hole shall provide a smooth transition free of notches. All weld access holes required to facilitate welding operations shall have a length (L) from the base of the weld preparation not less than 1.5H times the thickness of the material to which the hole is made. The height (H) of the access hole shall be adequate for deposition of sound weld metal in the adjacent plates. Access holes shall be shaped free of notches or sharp re-entrant corners.

PROPOSED REPAIR PROCEDURE
BIN 1045433  Route 305 Bridge
Town of Portella, Cattaraugus Co.
Region 6
RE: Flag # 55070022

GIRDER G1 (SPW-1 @ PIER 1)

Detail Sketch # 1
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PROPOSED REPAIR PROCEDURE

CUT STEELING STIFFENER ABOVE CUT LINE FOR WEB
(RECOMMENDED MIN. DEPTH D)

CUT STEELING / CONSTRUCTION PLATE (APPROX. MIN. THICK OF WEB)

CUT END OF EXISTING BEARING "W" AT LEAST 3" RADUS CLEAR (OPEN)

BOTTOM FlANGES

NOTE: CUT LINES ARE TO BE DETERMINED BY THE

RE: Fig # 55070022
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Sketch #3

**Sketch Notes:**
- Extension to the (bottom flange)
- Weld access hole (if reduced open)
- Access hole for lining
- Stiffener section A-A
- Cut line
- Bottom flange

Replacement lower portion of bearing stiffener:

* Horizontal cut line should be approximately 8 inches above horizontal web cut line.
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Common Steel repairs
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**Common Steel repairs**

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<table>
<thead>
<tr>
<th>MATERIAL SPECIFICATION</th>
<th>ASTM A-709</th>
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<tbody>
<tr>
<td>WELDING PROCESS</td>
<td>SMAW</td>
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<tr>
<td>MANUAL, SEMI-AUTOMATIC or AUTOMATIC</td>
<td>MANUAL</td>
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<tr>
<td>POSITION OF WELDING</td>
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<td>BACKGOUCE TO SOUND METAL, CLEAN TO BRIGHT METAL</td>
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<td>PREHEAT and INTERPASS TEMPERATURE</td>
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<td>POSTWELD TREATMENT</td>
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### Common Steel Repairs

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<table>
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<tr>
<th>PASS NO.</th>
<th>ELECTRODE SIZE</th>
<th>WELDING PARAMETERS</th>
<th>TRAVEL SPEED</th>
<th>JOINT DETAIL</th>
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<td>90 - 150</td>
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<tr>
<td>ALL</td>
<td>5/32&quot;</td>
<td>130 - 200</td>
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**Diagram:**

- NYSSCM Joint Detail B-U1B
- RADIUS OF BACKGOUGE 1/4" MINIMUM & SIDES SHALL SLOPE BACK W/ TOTAL INCLUDED ANGLE OF 20 DEGREES MINIMUM PER SEC.703 OF SCM
**Common Steel repairs**

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**BIN 1011690**

Repair Procedure

1) See general notes

2) Obtain 6 X 4 X ½” angle iron of proper length to use as a stiffener on the outside and inside of the fascia girders. Angle should be placed so that the 6 inch side is against the web.

3) Remove the bolts in the existing diaphragm connection to the web. Remove the fillet weld attaching the channel diaphragm to the connection plate. This connection plate may be discarded. Take care not to damage the channel iron.

4) Clamp the new 6 X 4 angle in place on the outside of girder and using the existing holes in the girder as a template, drill thru the angle. Clamp the inside angle in place and using the outside angle as a template drill thru the inside angle. The top and bottom inside edge of the angle may require grinding so that the legs of the angle bear on the top and bottom flange of the girder and the angle lays flat against the web. See sketch 1

5) Once the inside angle is in place clamp the channel iron to the angle and either drill holes for connecting the diaphragm to the stiffener or weld with 5/16” fillet welds.

6) Install new high strength bolts, nuts and washers through the new angle iron and the diaphragm connection plate. Torque to the required specs.
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Note: For 3⁄8" screws minimum edge distance is 1" from end of angle to center of hole. 2" between hole centers.

This connection may be altered or welded.

NEW ANGLE

6x4x1/2" Angle

Not to scale. All other details omitted to show stiffener.

SK1
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Lower Web Wastage Repair Sketch

Notes
15/16 inch holes
7/8 inch A325 bolts, nuts & washers
Plate both sides of web
Length of plates can be lengthened
Or shortened as long as edge distance and center
To center distance is not violated.

Lower edges of repair plate will require radius to fit web to flange radius.
GENERAL NOTES

1. Paint shall be removed at least 6 inches from areas of work before flame cutting, flame straightening, and air-arc gouging and or welding operations. This shall be done as directed by the Engineer.

2. Before welding, the areas to be welded shall be cleaned to bright metal and heated to 250°F. minimum and 400°F. maximum.

3. Flame cutting, air arc gouging and welding shall be performed by New York State D.O.T. certified welders ONLY.

4. Welding shall be done with ASW Classification E7018 electrodes, which shall be conditioned, stored and used in accordance with the provisions of Section 7 of the SCM. All welding shall be performed in accordance with an approved WPS.

5. Non-Destructive Testing (NDT) shall be performed in accordance with the provisions of the appropriate sections of the SCM.

6. Welded repairs which are made in tension areas of main members shall be ultrasonically tested (UT) by personnel from the Metals Engineering Unit of the State D.O.T. The D.C.E.S. shall be notified at least 5 working days in advance so that testing can be scheduled. Call (518) 457-4525 or (518) 485-5059 to schedule testing.

7. Repaired areas shall be repainted as directed by the Engineer.
Structural Lifting and Support

Structural Lifting Computations / Details
Structural Lifting and Support

Jacking considerations –

• Over Roadways –

• Over water -
Structural Lifting and Support

Jacking considerations –

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Access Issues

- Equipment needed –
Access Issues

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Case Study

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Maintenance Steel Repairs

Vischer Ferry Road over the Mohawk River Backchannel
BIN 4416010

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- Built in 1916
- 11 Span Steel Thru-girder
  - 588 ft. total length
- 16’ – 2” Rail to Rail
- CR = 3.406
- Gen. Rec. = 3
- 15 ton posting (2000)
  - Floorbeam deterioration
- 2008 Inspection yielded 26 flags
Vischer Ferry Road over the Mohawk River Backchannel
Now for the Cultural Portion of Our Presentation
Vischer Ferry, NY

- Named after Nicholas Vischer who built the first house in 1735
- Rope pulled ferry across the Mohawk built and operated by Eldert Vischer, circa 1800
- Replaced by bridge 1900
- Bridge destroyed by ice 1902
- Bridge over back-channel remains
  - I guess I’m lucky
Vischer’s Ferry
Typical Thru-girder Design
Interesting Design Features

- Foundations on timber cribbing in muck
Interesting Design Features

• Easily maintained steel bents
The Flag

- Floorbeam Connection Deterioration
- 6 locations
- Was Yellow in October
- Became Red in April
- Necessitated a 5 ton posting
Floorbeam Flags

- Connections deteriorated with nothing good left to connect to
Floorbeam Connection
The Fix
How to get the Floorbeam under the bridge
Erecting the Beam

- How to get the 23’ beam over the side of the bridge and across to the other thru-girder.
- Working over water
- Can’t violate the posting of the bridge (too much)
Repair Costs

• Floorbeam and plates - $1610.00
• Dywidag Rods and Hardware - $290.00
• Crane Operator from Canal Corp - $300.00
• Keeping the bridge out of the water – PRICELESS!
Bad Things ...
Bad Things …
Bad Things ...
Bad Things ...
Good Things … thru Steel Repairs
Good Things … thru Steel Repairs

>> Addresses Structural Flag issues

>> Maintain Emergency Services

>> Maintain access for local residents and businesses (e.g. commerce, school bus, farming, etc.)

>> Preserves investment and vital links to statewide infrastructure

>> The “PRICELESS” option – keeps the bridge out of water or traffic below … and open.
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Contact Information

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•For References and Manuals

https://www.nysdot.gov/divisions/engineering/structures/manuals#engserv