Chapter 11 - Structural Repairs

SECTION 03

JACKING SYSTEMS (SR-JS)
Chapter 11 - Structural Repairs

Section 03 – Jacking Systems

SUB-SECTION 01

JACKING BEAM
(SR-JS(JB))
DESIGN GUIDELINES FOR JACKING BEAMS

1) The temporary jacking system is to be designed at operating stress levels.

2) A five percent increase to the dead load beam reaction is required for deck stiffness.

3) Bolts shall be ASTM A 325 with the threads included in the shear plane if possible. The connection shall be designed in bearing with the reduced root area. ASTM A 490 bolts are acceptable.

4) Minimum stiffener and connection plate thickness shall be \( \frac{5}{16} '' \).

5) Designers should attempt to minimize the number of different jacking systems for the bridge by designing a system that will work in multiple locations.

6) Minimum fillet weld size shall be \( \frac{5}{8} '' \).

7) Avoid bent connection plates where possible. If the skew angle does not allow placing straight connection plates from the existing stiffener to the web, attach the connection plate full height to the existing web and design it as a stiffener. Place it far enough from the existing stiffener to allow welding the connection plate to the web and still have full bearing under the jacking system.

8) The jack stand can only accommodate a jack with a diameter of 6'' or less. Most jacks greater than 75 tons will require a different stand.

9) The possibility of shifting traffic off of the stringer to be jacked should be discussed with the ADE-Traffic. This would allow designing for only dead load.

10) When designing a jacking beam the designer may want to start with the following trial sections:

<table>
<thead>
<tr>
<th>* LOAD (X)</th>
<th>BOLTS</th>
<th>BEAM</th>
<th>CONNECTION PLATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>( X \leq 35K )</td>
<td>3 - ( \frac{7}{8} '' ) A 325</td>
<td>W 12 x 26</td>
<td>( \frac{1}{2} '' \times 9'' )</td>
</tr>
<tr>
<td>35K &lt; X &lt; 45K</td>
<td>3 - 1'' A 325</td>
<td>W 14 x 26</td>
<td>( \frac{1}{2} '' \times 11'' )</td>
</tr>
<tr>
<td>45K &lt; X &lt; 60K</td>
<td>4 - 1'' A 325</td>
<td>W 18 x 35</td>
<td>( \frac{1}{2} '' \times 14\frac{1}{2}'' )</td>
</tr>
<tr>
<td>60K &lt; X &lt; 80K</td>
<td>4 - 1'' A 490</td>
<td>W 18 x 35</td>
<td>( \frac{1}{2} '' \times 18'' )</td>
</tr>
</tbody>
</table>

* Load (X) is dead load and live load plus impact at the bolts

* FOR OFFICE USE ONLY *
## EXTERIOR - JACKING BEAM

**Scale:** None

### JACKING BEAM TABLE

<table>
<thead>
<tr>
<th>Jacking Beam</th>
<th>Size:</th>
<th>Location:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel Grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stiffener Plate Size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jack Offset</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Jack Force</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Section Modulus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Cross Sectional Web Area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Web Thickness</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Jacking beams do not have to be new, but shall be in good condition.
2. The jack shall not be used to support load during bearing repairs.
3. Jacking beams shall be placed level unless otherwise noted.
4. The Contractor has the option of submitting another method of jacking to the Engineer for approval. The design shall be done by a PE registered in Md.
5. Jacking beams shall be kept low to minimize height of stacked plates or the HP column jack support.
6. Anchor bolt nuts may need to be loosened at the exterior and adjacent interior stringers to allow the stringer to rise.
7. Stringers shall not be raised more than 1/8" above its existing elevation.
Notes:
1. Jacking beams do not have to be new, but shall be in good condition.
2. The jack shall not be used to support load during bearing repairs.
3. Jacking beams shall be placed level unless otherwise noted.
4. The Contractor has the option of submitting another method of jacking to the Engineer for approval. The design shall be done by a PE registered in Md.
5. Jacking beams shall be kept low to minimize height of stacked plates or the HP column jack support.
6. Anchor bolt nuts may need to be loosened at the exterior and adjacent interior stringers to allow the stringer to rise.
7. Stringers shall not be raised more than \(\frac{1}{8}\)" above its existing elevation.
TYPICAL SKEWED CONNECTION DETAIL

ELEVATION

Typical skewed connection detail

Notes:
Any steel that has been welded to the existing bridge shall remain in place. The repaired area and any other areas damaged shall be repaired in conformance with 430.
## TYPICAL 90° CONNECTION DETAIL

**Scale:** None

### CONNECTION DETAILS

<table>
<thead>
<tr>
<th>Materials:</th>
<th>Location:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection Plate Size</td>
<td></td>
</tr>
<tr>
<td>Connection Plate Weld</td>
<td></td>
</tr>
<tr>
<td>Number of Bolts</td>
<td></td>
</tr>
<tr>
<td>Bolt (Type and Size)</td>
<td></td>
</tr>
<tr>
<td>Bolt Spacing c/c</td>
<td></td>
</tr>
<tr>
<td>Existing Stiffener Plate Size</td>
<td></td>
</tr>
<tr>
<td>Steel Grade</td>
<td></td>
</tr>
</tbody>
</table>

### Notes:

Any steel that has been welded to the existing bridge shall remain in place. The repaired area and any other areas damaged shall be repaired in conformance with 430.
JACK SUPPORT USING STACKED PLATES

Scale: None

ELEVATION

1. Jack, plates, and stiffener and jack support assembly

JACK SUPPORT ASSEMBLY

Scale: None

ELEVATION

ALTERNATE COLUMN SPACER DETAIL

Scale: None

ELEVATION

Notes:
1. Minimum thickness of the grout leveling pad shall be as recommended by manufacturer.
2. Jack shall be centered under jacking beam web and stiffeners.
3. Stacked plates shall not exceed 12" high.
4. HP8 x 36 column spacer shall not exceed 5'-0" high.
5. All material to be ASTM A 709 Grade 36 or Grade 50 as approved by the engineer.
**SHIM PLATE DETAIL**

Scale: None

- Jack piston radius plus \(\frac{1}{4}''\)
- Shim plate
- \(\frac{1}{4}''\) (min.) \(\times\) 12'' \(\times\) 1'-0'' Plate
- Jack piston diameter plus \(\frac{1}{2}''\)
- Equal spacer

Note:
This plate is not welded to the jack support assembly.

**SECTION A-A**

Scale: None

- Jack, plates, and channels
- \(\frac{5}{16}''\) \(\times\) 1'-0'' Plate
- \(\frac{1}{8}''\) typ.
- C9 \(\times\) 15 (Typ.)
- 1'' \(\times\) 12'' \(\times\) 1'-0'' Base plate
- Jack
- 3''
- 3''

Note:
The length of the channels and the \(\frac{1}{2}''\) plate are to be custom fit to the jack being used.
<table>
<thead>
<tr>
<th>SUPPORT &amp; SPAN</th>
<th>MEMBER</th>
<th>EXPECTED MINIMUM FORCE (LBS)</th>
<th>EXPECTED MAXIMUM FORCE (LBS)</th>
<th>JACK PISTON DIAMETER (IN)</th>
<th>RECORDED LIFT PRESSURE READING (PSI)</th>
<th>RECORDED MAXIMUM PRESSURE READING (PSI)</th>
<th>CALCULATED MAXIMUM FORCE (LBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENG.</td>
<td>ENG.</td>
<td>ENG.</td>
<td>ENG.</td>
<td>INSP.</td>
<td>INSP.</td>
<td>INSP.</td>
<td>INSP.</td>
</tr>
</tbody>
</table>

**CALCULATED MAXIMUM FORCE = [RECORDED MAXIMUM PRESSURE READING] * [0.785 * JACK PISTON DIAMETER]**
Chapter 11 - Structural Repairs

Section 03 – Jacking Systems

SUB-SECTION 02

PRESTRESSING BAR
(SR-JS(PSB))
DESIGN GUIDELINES FOR JACKING BEAMS USING PRESTRESSING BARS

1. A five percent increase to the dead load beam reaction is required for deck stiffness.

2. Prestressing Bars (i.e., Dywidags or All-Thread Bars) shall have an ultimate tensile strength of 150KSI (fpu) and have a diameter of 1 3/8”.

3. The prestressing load (i.e., the resulting tensile force required to counter the DL + LL + Impact loads) of the prestressing steel shall be 60% of the specified minimum tensile strength (fpu).

4. The ultimate strength in shear shall be evaluated at 60% of the ultimate tensile strength (fpu).

5. The lock-off load should not exceed 70% of the specified minimum tensile strength of the prestressing steel. This accounts for a 10% relaxation of the prestressing steel.

6. Each Bracket shall be connected to the Pier Cap with a minimum of 4-prestressing bars.

7. Once the number of prestressing bars have been selected, the designer shall place the bars on the Pier Cap in such a way to avoid all primary reinforcing steel as based on existing plans. The designer shall add a note to the plans requiring the contractor to verify the location of the primary reinforcing steel prior to drilling for any prestressing bars.

8. The minimum edge distance for the placement of the brackets shall be 12” from the edge of the nearest drilled hole.

9. The Jack Support Assembly, Brackets, and Cap Plates have been designed for a maximum design load (i.e., DL + LL + Impact loads) of 220-KIPS.

10. For design loads greater than 220-KIPS, the designer shall consider the possibility of shifting traffic off of the member to be jacked to remove the LL+Impact loads. This option shall be discussed with the Division Chief before discussing with the ADE of Traffic.

11. The Jack Support Assembly has been fabricated to accommodate standard jack and pancake jack diameters up to 9.5”.

12. The exterior flange of the Brackets have been designed for a maximum lock-off load of 136-kips.

13. The designer shall evaluate the compressive capacity of the Pier Cap with respect to the group prestressing lock-off load. The compressive capacity of the Pier Cap shall be taken as 0.3fc'.
**JACK SUPPORT USING STACKED PLATES**

Scale: None

Note:
The contractor may use the column spacer instead of stacked plates. The column spacer shall be used for heights greater than 12" to a maximum of 5'-0" high.

**ELEVATION**

**ALTERNATE COLUMN SPACER DETAIL**

Scale: None

Notes:
1. Minimum thickness of the grout leveling pad shall be as recommended by manufacturer.
2. Jack shall be centered under jacking beam web and stiffeners.
3. Stacked plates shall not exceed 12" high.
4. HPI4x73 column spacer shall not exceed 5'-0" high.
5. All material to be ASTM A 709 Grade 50.
NOTES:
1. All steel shall be ASTM A709, Grade 50.
2. For skewed members and/or substructure units, refer to the Cap Supplement Detail.

ENERPAC CLP-1602 and smaller jack

JACKING ASSEMBLY ELEVATION

JACK SUPPORT ASSEMBLY
FOR PRESTRESSING BAR BRACKETS

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

APPROVAL

DETAIL NO. SR-JS(JPSB)-102
SHEET 2 OF 2
PIER FACE BRACKET DETAIL
Scale: 1" = 1'-0"

2 in. Dia. hole in both flanges and base plate (typ.)

HPI4X73 Welded to a 1 3/4"T X 15 3/4"W X 36"H base plate

5/8"T X 7"W X full height stiffeners spaced 1" from holes (typ.)

Note: Cap plates not shown for clarity.

SECTION A-A
Scale: 1" = 1'-0"

2 in. Dia. hole in both flanges and base plate (typ.)

HPI4X73

5/8"T X 7"W X full height stiffeners (typ.)

1 3/4"T X 15 3/4"W X 36"H base plate

See Note 1
Notes:
1. Chamfer new plate as shown to clear fillet so that edges of plate fit flush against flange and web of HP Section.
2. All steel shall be ASTM A709, Grade 50.
3. For skewed members and/or substructure units, refer to The Cap Supplement Detail.
PIER FACE BRACKET DETAIL
SCALE: 1" = 1'-0"

2" Dia. hole in both flanges and base plate (typ.)

HPI4X73 (typ.)

5/8" T X 7" W X full height stiffeners (typ.)

1 3/4" T X 15 1/4" W X 36" H base plate

See NOTE 1

Note:
Cap plates not shown for clarity.
For skewed members and/or substructure units, refer to the cap supplement detail.

Notes:
1. Chamfer new plate as shown to clear fillet so that edges of plate fit flush against flange and web of HP Section.
2. All steel shall be ASTM A709, GRADE 50.
3. For skewed members and/or substructure units, refer to the cap supplement detail.
CAP SUPPLEMENT DETAIL

ELEVATION

SCALE: 1" = 1'-0"

SECTION A-A

SCALE: 1" = 1'-0"

1" cap plate for skewed members

1/2 Brace plate (typ.)
Note:
Jack support shall be placed along the same skew of the existing member being jacked.
1" brace plate

1/2" brace plate (typ.)

1" cap plate for skewed members

ELEVATION
SCALE: 1" = 1'-0"

SECTION A-A
SCALE: 1" = 1'-0"
Place brace plate to avoid cap plate

1 1/2 cap plate for skewed members

HP14X73

5/16

1'-8 7/8

10" Max.

Tack

Existing pier cap face

Girder centerline

Jack support

Note: Jack support shall be placed along the same skew of the existing member being jacked.

MAX JACK SUPPORT OFFSET

SCALE: 1" = 1'-0"
### Prestressing Bar Tensions and Jacking Chart

<table>
<thead>
<tr>
<th>Support &amp; Span</th>
<th>Bracket No.</th>
<th>No. 1(^\frac{1}{2}) Dia. Bars</th>
<th>Required Tension (LBS)</th>
<th>Member</th>
<th>Expected Minimum Force (LBS)</th>
<th>Expected Maximum Force (LBS)</th>
<th>Jack Piston Diameter (IN)</th>
<th>Recorded Lift Pressure Reading (PSI)</th>
<th>Recorded Maximum Pressure Reading (PSI)</th>
<th>Calculated Maximum Force (LBS)</th>
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</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

Calculated Maximum Force = \[\text{Recorded Maximum Pressure Reading} \times (0.785 \times \text{Jack Piston Diameter}^2)\]

* Prestressed Bar Tension accounts for a 10% relaxation of the Bar. The tension shown in the chart above is the maximum tension to be applied in the field.
Chapter 11 - Structural Repairs

Section 03 – Jacking Systems

SUB-SECTION 03

CHANNEL BRACKET
(SR-JS(CB))
DESIGN GUIDELINES FOR DOUBLE CHANNEL JACKING BRACKETS

1) The temporary jacking system has been designed at operating stress levels.

2) Bolts shall be ASTM A 490 with the threads included in the shear plane if possible. The connection has been designed as a slip-critical connection.

3) Designers should attempt to minimize the number of different jacking systems for the bridge by designing a system that will work in multiple locations.

4) Only the members shown below are to be selected for the jacking member(s).

5) Members sizes, allowable loads, maximum lifting capacity, and offsets shall be shown in the standards.

6) Designers shall evaluate the adjacent member for uplift. If uplift occurs, either eliminate uplift or account for uplift by jacking the adjacent member or by other means approved by the SRED Team Leader and/or the SRED Division Chief.

7) Once jacking repairs are complete, install beam and retrofit plates as per the Bearing Stiffener Plating Detail (SR-ST-30X) or the Girder End Plating Detail (SR-ST-40X or SR-ST-50X).

<table>
<thead>
<tr>
<th>Bracket Member</th>
<th>2 - C8x18.75</th>
<th>2 - C10x30</th>
<th>2 - C12x30</th>
<th>2 - C15x50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off Set (ft)</td>
<td>1.5ft</td>
<td>22.00</td>
<td>34.00</td>
<td>49.00</td>
</tr>
<tr>
<td></td>
<td>2.0ft</td>
<td>16.00</td>
<td>28.00</td>
<td>36.00</td>
</tr>
<tr>
<td></td>
<td>2.5ft</td>
<td>NG, Deflection</td>
<td>NG, Deflection</td>
<td>NG, Deflection</td>
</tr>
<tr>
<td></td>
<td>3.0ft</td>
<td>NG, Deflection</td>
<td>NG, Deflection</td>
<td>NG, Deflection</td>
</tr>
</tbody>
</table>

| Fillet Weld Width | 1/8” | 3/8” | 5/8” |
| Stiffener Width   | 2”   | 2 7/8”   | 2 5/8” |
| Total No. Stiffener | 2/Stiffener =4 | 2/Stiffener =4 | 3/Stiffener =6 | 4/Stiffener =8 |

<table>
<thead>
<tr>
<th>Max Combined Lifting Capacity (kips)</th>
<th>2 - C8x18.75</th>
<th>2 - C10x30</th>
<th>2 - C12x30</th>
<th>2 - C15x50</th>
</tr>
</thead>
<tbody>
<tr>
<td>44.00</td>
<td>68.00</td>
<td>98.00</td>
<td>120.00</td>
<td></td>
</tr>
<tr>
<td>16.00</td>
<td>28.00</td>
<td>36.00</td>
<td>100.00</td>
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<tr>
<td>NG, Deflection</td>
<td>NG, Deflection</td>
<td>NG, Deflection</td>
<td>NG, Deflection</td>
<td>85.00</td>
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<td>NG, Deflection</td>
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<td>NG, Deflection</td>
<td>NG, Deflection</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Width</th>
<th>1/8”</th>
<th>3/8”</th>
<th>5/8”</th>
</tr>
</thead>
<tbody>
<tr>
<td>2”</td>
<td>2 7/8”</td>
<td>2 5/8”</td>
<td></td>
</tr>
<tr>
<td>3”</td>
<td>2 5/8”</td>
<td>3”</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total No. Stiffener</th>
<th>2/Stiffener =4</th>
<th>2/Stiffener =4</th>
<th>3/Stiffener =6</th>
<th>4/Stiffener =8</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/Conn. Plate</td>
<td>8</td>
<td>8</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>6/Conn. Plate</td>
<td>12</td>
<td>12</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>8/Conn. Plate</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>
**CHANNEL BRACKET JACKING MEMBER**

**SCALE:** None

<table>
<thead>
<tr>
<th>JACKING MEMBER TABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Sizes</strong></td>
</tr>
<tr>
<td>L₁, Length of fill plate along bracket</td>
</tr>
<tr>
<td>Proposed Bracket Stiffener Plate Size</td>
</tr>
<tr>
<td>L₂, Length of fill plate at ext. stiffener</td>
</tr>
<tr>
<td>Jack Offset</td>
</tr>
<tr>
<td>Maximum Jack Force</td>
</tr>
<tr>
<td>Required Jack Capacity</td>
</tr>
</tbody>
</table>

**Notes:**
1. Only A709 Grade 50 steel shall be used.
2. Jacking members do not have to be new, but shall be in good condition.
3. The jack shall not be used to support load during bearing repairs.
4. Jacking members shall be placed level unless otherwise noted.
5. The Contractor has the option of submitting another method of jacking to the Engineer for approval. The design shall be done by a PE registered in Md.
6. Jacking member shall be kept low to minimize height of stacked plates or the HP column jack support.
7. Anchor bolt nuts may need to be loosened at the exterior and adjacent interior beams to allow the beam to rise.
8. Beams shall not be raised more than 1/8" above its existing elevation.
9. Proposed stiffener plates shall be fabricated to bear directly on and match the slope of the flanges of the proposed channel sections.
10. Chipping of the existing concrete is not required for the jack stand leveling pad unless approved by the engineer.
11. The entire procedure (jacking, debris removal, shim installation, lowering, and bracket removal) shall be completed in a timely manner as approved by the Engineer.
12. Once jacking repairs are complete, install beam end retrofit plates as the Bearing Stiffener Plating Standard or the Girder End Plating Standards as attached. Retrofit bolt spacing shall incorporate all bolt holes used for jacking.

**STATE OF MARYLAND**

**DEPARTMENT OF TRANSPORTATION**

**STATE HIGHWAY ADMINISTRATION**

**OFFICE OF STRUCTURES**

**CHANNEL BRACKET JACKING DETAILS**

**APPROVAL**

**DATE:** 06/28/2017

**VERSION:** 1.0

**DETAIL NO.** SR-J3(CB)-102

**SHEET 1 OF 5**
**Typical 90° Connection Detail**

**Details**

**Location:**

- Materials:
  - Connection Bolts: A490, 7/8" dia.
  - Bevel member to match existing weld (Typ.)

**Connection Details**

<table>
<thead>
<tr>
<th>Description</th>
<th>Materials</th>
<th>Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double C-Channel Jacking Member</td>
<td>W - Connection plate weld size</td>
<td></td>
</tr>
<tr>
<td>W - Connection plate weld size</td>
<td>Connection Bolts: A490, 7/8&quot; dia.</td>
<td></td>
</tr>
<tr>
<td>b1 - No. Bracket Connection Plate Bolts</td>
<td>_ per side = _ total</td>
<td></td>
</tr>
<tr>
<td>b2 - No. Connection Bolts in existing stiffener</td>
<td>_ per side = _ total</td>
<td></td>
</tr>
<tr>
<td>No. Bracket Connection Bolt Rows</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**

1. Minimum height of connection plate: 9 1/4" for C8x18.75; 11 1/4" for C10x30; 13 1/4" for C12x30; & 16 1/4" for C15x50.
2. b - Number of 7/8" dia. A490 Bolts required on each bracket connection plate and existing stiffener.
3. W - Connection plate weld size, E70 electrodes.
4. The gap between the channel webs shall be located at the span side of the stiffener.
5. Jacking members shall be placed as close as possible to the end diaphragm.
6. New bolts to be reinstalled in bolt holes after jacking unless otherwise stated in the plans.

**Approval**

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

CHANNEL BRACKET JACKING DETAILS

DETAIL NO. SR-JS(CB)-102

SHEET 2 OF 5
CHANNEL BRACKET JACKING DETAILS

**EXISTING BEAM WEB FILL PLATE DETAIL**

**CONNECTION DETAILS**

<table>
<thead>
<tr>
<th>Materials</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximate Existing Beam Web Thickness</td>
<td></td>
</tr>
<tr>
<td>H, Height of Proposed Web/Bracket Fill Plates</td>
<td></td>
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<td>L₁, Length of Web Fill Plate</td>
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<td>L₂, Length of Bracket Fill Plate</td>
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**Notes:**
1. This sheet shall be used if the end of the Existing Beam is less than 6 5/8" long.
2. The Contractor may be required to tighten bolts using wrenches and other similar hand tools due to space limitations. If bolts cannot be tightened to the Engineer’s approval, work shall cease and the Engineer shall contact SIRE for direction.
3. All existing beam dimensions shall be field verified before any material is ordered, fabricated, or installed.

**APPROVAL**

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

**CHANNEL BRACKET JACKING DETAILS**

**DETAIL NO. SR-JS(CB)-102**

**SHEET 3 OF 5**
Notes:
1. Minimum thickness of the grout leveling pad shall be as recommended by manufacturer.
2. Jack shall be centered under jacking beam web and stiffeners.
3. Stacked plates shall not exceed 12" high.
4. HP8 x 36 column spacer shall not exceed 5'-0" high.
5. All material for the Jack Support and Column Spacer to be ASTM A 709 Grade 50. Grade 36 is also acceptable with the approval of the Engineer.
Jack piston radius plus 1/4"

1/4" min. x 12" x 1'-0" Plate

Jack piston diameter plus 1/2"

Equal spacer

Note: This plate is not welded to the jack support assembly.

Note: The length of the channels and the 1/2" plate are to be custom fit to the jack being used.
### JACKING CHART

<table>
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<tr>
<th>SUPPORT &amp; SPAN</th>
<th>MEMBER</th>
<th>EXPECTED MINIMUM FORCE (LBS)</th>
<th>EXPECTED MAXIMUM FORCE (LBS)</th>
<th>JACK PISTON DIAMETER (IN)</th>
<th>RECORDED LIFT PRESSURE READING (PSI)</th>
<th>RECORDED MAXIMUM PRESSURE READING (PSI)</th>
<th>CALCULATED MAXIMUM FORCE (LBS)</th>
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CALCULATED MAXIMUM FORCE = [ RECORDED MAXIMUM PRESSURE READING ] * [ 0.785 * JACK PISTON DIAMETER² ]