Stay-form Applications: Bulkheads or Construction Joints

By Gary J. Maylon

No matter what size bulkhead, Stay-form will save money on every project.
Stay-form: the Stay-in-Place Concrete Form
Bulkhead Applications

One of the most common applications for Stay-form is in the formation of bulkheads or construction joints in walls, base pours, slabs, footings, highway and bridge pours, and anywhere else that a single area of concrete must be divided for multiple sections or pours. There is no other product on the market today that is superior to Stay-form as a bulkhead form. The contractor will realize significant savings in forming time and cost on every stay-form bulkhead installed.

Advantages over wood or modular forms:

1. **Forms Easily:** Stay-form easily forms into multiple configurations to accommodate shapes for keyways or unusual forms. Stay-form also can be used to form curves or radiuses. To make corner bends, ribs can be notched to a 45-degree angle leaving the mesh between the ribs intact. By bending the remaining mesh to the desired angle, a perfectly formed corner can be formed. Multiple sections of Stay-form can be joined end to end with a 3-inch to 4-inch lap and over lapped one or two ribs to accomplish a side lap. End laps should always occur at a support.

2. **Cuts to Size Easily:** Stay-form is shipped in five sheet wire tied bundles. Single or multiple lengths or pieces can be cut utilizing a circular saw with an abrasive metal cutting blade. Snios
This rough surface combined with the ¾ inch ribs that are spaced approximately 4 inches apart provides the perfect surface texture for the subsequent pour.

5. **No Stripping Required:** Since Stay-form is a stay-in-place concrete form no stripping is required. This means that you can leave the pry bar in the truck. This provides not only a labor savings in stripping cost, but also saves time and money that would be spent cleaning, oiling, moving and storing the plywood or modular forms. It also saves the cost of form release chemicals.

6. **No Hop Scotching Around:** Stay-form allows the contractor to anticipate bulkhead locations and place them at the appropriate locations. The contractor can continue tying steel rather than hop scotching to every other pour to allow for stripping forms. By allowing the contractor to continue tying reinforcing steel Stay-form provides a continuity of work and a cost savings in time on the labor-intensive job. It is always better if a trade can begin a project and work uninterrupted to the completion of their portion of the project.

7. **Pour One Side Today and the Next Side Tomorrow:** Since Stay-form stays-in-place and is never stripped, the contractor can pour one side today and the other side tomorrow. Some engineers require forms to remain in place two to three days before stripping of the forms is allowed to proceed. This can add up to many extra weeks that the contractor must spend on the forming portion of the project.

8. **Stay-form Provides Far Better Shear Bonds:** Stay-form was compared to B-Matte form board for the forming of bulkheads. Shear bond strength of the resulting joints were tested at 5 days, 14 days and 28 days. The joints formed with Stay-form produced 21% greater shear bonds at 28 days than the wood formed joints that were roughened or scabbled to ¼-
Installation Techniques:

Stay-form bulkheads are installed at a right angle to the rebar mats and fill the space from the grade or mud slab to the bottom edge of the steel cover. This cover usually takes the form of a piece of lumber that spans the distance from the top or bottom edge of the rebar mat to the top surface of the pour. In the case of walls, steel coverage may be required on both surfaces.

Stay-form can easily be notched to fit over the bottom and top mat of rebars. Tie wire is often used to connect the slit sections together below the mat. For relatively small pours sections of scrap rebar are then placed vertically or horizontally for wall applications, and wire tied to the top and bottom mats. Spacing on the vertical supports can be determined by reviewing the load table located in the Stay-form detail manual and in this document.

For larger base pours it might be necessary to use wooden or steel strongbacks or specially designed rebar sections as vertical supports. Generally all other types of stud or waler supports are removed before subsequent pours. Stay-form is then attached to the supports using tie wire for metal supports or roofing nails, staples, tacks or similar fasteners for wooden supports. Fasteners are installed through the Stay-form into the supports from the first pour side. Sheets should be placed with ribs into the first pour and the flat backside of the sheet in contact with the supports.

Attached are details showing some of the more common methods of forming bulkheads and some photos that
Forming Wall or Slab Bulkhead/Construction Joint Using Stay-form

1. **Conventional Form**
   - **Rebar**
   - **Template Stringers Wire-tied to Rebar**
   - **Blocking for Cover**
   - **Reusable Pencil Rod is welded to #4 Crossrods which, in turn are welded to the #4 Stringers to form a template on which to form a Stay-form Wall or Slab Bulkhead.**

2. **Stay-form**
   - **Stay-form Wire-tied to Template**
   - **After 1st Placement, Wires for Stay-form Attachment are cut and template is removed for reuse.**
   - **#4 Crossrods are welded to the #4 Stringers to form a template on which to form a Stay-form Wall or Slab Bulkhead.**

3. **Conventional Form**
   - **Rebar**
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4. **Construction Joint Profile Support from Wooden 2 x 4 (Typical)**
   - **Stayform Joint**
   - **Top Cover Allowance for Stay-form**
   - **Beam Side Forms**

**Note:** Rebar can penetrate Stay-form
Forming Wall or Heavy Bulkhead/Construction Joint Using Stay-form

- **Wood Rail Nailed to Supports**
- **Stay-form Skirt** Notched to Fit Around Rebar
- **Conventional Form**
- **Cover**
- **Blocking for Cover**
- **Horizontal Rebar Passing Through Stay-form**
- **Horizontal Supports @ 16" - 24" O.C.**
- **Vertical Runners (Each Side)**
- **Conventional Forms (Both Sides)**

**Notes:**
- If nail or staples by which stay-form is fastened to wood supports are chosen properly, wood support lattice may be reused.
Williams Form Engineering Corp.
809 NE Lombard Street
Portland, Oregon 97211

Attn: Mr. Mike Bowles

Re: Puget Sound Naval Ship Yard Parking Structure
#P-300-T - Bremerton, Washington 98310
Bond Strength Comparison Testing

Gentlemen:

As requested, we have completed concrete bond strength comparison testing to determine if your Stay-Form #66 product produces equal to or greater bond strength values than that of a typical B-Matte form board material. Sixteen 8” x 8” x 8” form boxes were constructed, with eight of these boxes having B-Matte form board bulk head partitions that separated the original form box dimensions into two equal 4” x 8” x 8” sections. In addition, the remaining eight form boxes were bulk head partitioned with your Stay-Form #66 product producing the same equal 4” x 8” x 8” sections. Concrete was placed into the first 4” x 8” x 8” portions of all the form boxes on February 20, 1996, allowed to cure for one day, and the remaining 4” x 8” x 8” portions of the form boxes had concrete placed and filling the form boxes to full on February 21, 1996. Please see concrete mix data and test results in the data portion of the report. All specimens were cured in ambient air until the appropriate test dates. Following is the test data:

**SHEAR BOND STRENGTH (Modified ASTM C482):**

<table>
<thead>
<tr>
<th>TEST AGE</th>
<th>B-MATTE TOTAL LOAD</th>
<th>B-MATTE SHEAR BOND STRENGTH</th>
<th>STAY-FORM TOTAL LOAD</th>
<th>STAY-FORM SHEAR BOND STRENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/6 day</td>
<td>16,750 LB.</td>
<td>344.6 psi</td>
<td>36,700 LB.</td>
<td>414.9 psi</td>
</tr>
<tr>
<td>13/14 day</td>
<td>12,750 LB.</td>
<td>200.3 psi</td>
<td>16,200 LB.</td>
<td>249.7 psi</td>
</tr>
<tr>
<td>27/28 day</td>
<td>15,200 LB.</td>
<td>238.9 psi</td>
<td>19,525 LB.</td>
<td>303.9 psi</td>
</tr>
</tbody>
</table>
DETERMINING BOND STRENGTH BETWEEN HARDENED ROLLER COMPACTED CONCRETE AND OTHER HARDENED CEMIINTATIONS MIXTURES - ASTM C1245:

Note: Procedures described in ASTM C1245 state that this method is applicable to all type of layered concrete construction involving an upper layer of concrete or mortar bonded to an underlaying layer of concrete or mortar where the total depth is sufficient to meet the minimum specimen length and diameter requirements of the test method.

<table>
<thead>
<tr>
<th>TEST AGE</th>
<th>B-MATTE TOTAL LOAD</th>
<th>B-MATTE SHEAR BOND STRENGTH</th>
<th>STAY-FORM TOTAL LOAD</th>
<th>STAY-FORM SHEAR BOND STRENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/6 day</td>
<td>2,225 LB.</td>
<td>139 psi</td>
<td>3,475 LB.</td>
<td>217 psi</td>
</tr>
<tr>
<td>13/14 day</td>
<td>2,150 LB.</td>
<td>134 psi</td>
<td>3,075 LB.</td>
<td>192 psi</td>
</tr>
<tr>
<td>27/28 day</td>
<td>2,425 LB.</td>
<td>152 psi</td>
<td>3,250 LB.</td>
<td>203 psi</td>
</tr>
</tbody>
</table>

Specimen size: 4” diameter x 8” length (drilled cores)

At 5/6 days, the tensile strength (bond) test data indicated that the Stay-Form #66 test was 36% greater than that of the identically cast test specimen using the B-Matte form board material.

At 13/14 days, the tensile strength (bond) test data indicated that the Stay-Form #66 test was 30% greater than that of the identically cast test specimen using the B-Matte form board material.

At 27/28 days, the tensile strength (bond) test data indicated that the Stay-Form #66 test was 25% greater than that of the identically cast test specimen using the B-Matte form board material.

Note #1: Roughing of the B-Matte bulk head surfaces to a depth of approximately 1/4-inch was done to all B-Matte specimens cast prior to the adjacent pour.

Note #2: No visible voids or air pockets were noted around the concrete adjacent to the Stay-Form #66 bulk head, or for that matter, any bulk heads of specimens tested.

Concrete data:
Concrete Producer: Lonestar Northwest
Mix Type: #837 - 3/8” max. aggregate size
Slump: 5 1/2” (pour #1) & 8 1/2” (pour #2)
Air Content: 3.4% (pour #1) & 0.8% (pour #2)
Concrete Temperature: 56°F (pour #1) & 54°F (pour #2)
Unit Weight: 149.6pcf (pour #1) & 147.5pcf (pour #2)

Our reports pertain to the material tested/inspected only. Information contained herein is not to be reproduced, except in full, without prior authorization from this office.

If there are any further questions regarding this matter, please do not hesitate to contact this office.
Pictures 1
Pictures 2
GUIDE LINES FOR LOADING SPECIFICATIONS
Support Spacing (Running Perpendicular to Stay-Form Ribs)

<table>
<thead>
<tr>
<th>SUPPORT SPACING</th>
<th>30&quot; ON CENTER</th>
<th>24&quot; ON CENTER</th>
<th>16&quot; ON CENTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stay-Form Type</td>
<td>#66</td>
<td>#66</td>
<td>#66</td>
</tr>
<tr>
<td>Lateral Loading (psi)</td>
<td>391</td>
<td>612</td>
<td>1360</td>
</tr>
<tr>
<td>Liquid Head (feet)</td>
<td>2.6</td>
<td>4.1</td>
<td>9.1</td>
</tr>
<tr>
<td>Pour Rate (feet / hour)</td>
<td>1.3</td>
<td>2.6</td>
<td>6.1</td>
</tr>
<tr>
<td>Maximum Deflection (inches)</td>
<td>1.42</td>
<td>0.92</td>
<td>0.43</td>
</tr>
</tbody>
</table>

THE ABOVE LOADING SPECIFICATIONS ARE BASED ON THE FOLLOWING CONDITIONS:

1. Optimum density of wet concrete should be @ 150 lbs./ft.³ and 50°F temperature.
2. Concrete discharge nozzle at no more than 2 feet above the pour surface.
3. Each rib saddle-tied at each support with 16 Ga. tie-wire in "figure 8" configuration.
4. End laps require at least 2" of Stay-Form over lapsing each other. Laps should occur over a support with both adjoining sheets secured with wire ties at the lap as well as over and around the support.
5. Side laps require outside rib of each adjoining sheet be nested into the other and wire-tied at a maximum of 12" on center.
6. Place Stay-Form with ribs facing away from supports and projecting toward and into pour.
7. Concrete to be prepared with a 3" to 6" slump. Higher slump rates can be used but may result in some grout flow through the Stay-Form. Pour rates listed in the table above are without additives or retarders.
8. The data above is extrapolated from preliminary physical testing with 100% safety factor applied.
9. When side lapsing sheets of Stay-Form, which may include less than full sheet widths, the Stay-Form is cut to allow side lapsing of the ribs and is then wire-tied maintaining a maximum distance between ties of 12" on centers between supports if at all possible. (see Side Lap Detail below)
10. The loading guidelines listed above are based on a continuous spar configuration.
11. CAUTION: When consolidating concrete, keep vibrator at least 4" away from Stay-Form. Be sure not to allow vibrator to come into physical contact with Stay-Form. When Stay-Form is used with conventional sheathing on opposite side for wall forming, use external form vibrator on conventional liner, if possible, for compaction. Otherwise, hand compact with grating tamper.
12. If Stay-Form is applied on wooden supports, fasten Stay-Form to supports with 14 ga. circular crown staples straddling each rib crossing each support driven deep enough to clinch the rib but not deep enough to deform the rib. Use two staples for each rib over an end lap and at the end supports.

STAPLE STRADDLING EACH RIB WITH 1" MIN. PENETRATION INTO WOOD

STAY-FORM WITH RIBS CROSSING SUPPORTS AT RIGHT ANGLES

LAP WIRE-TIED A MAXIMUM OF 12" ON CENTER