NEWS & INFORMATION FROM HAMILTON FORM

Form & Function

WINTER 2010

A Tale of Two Tees

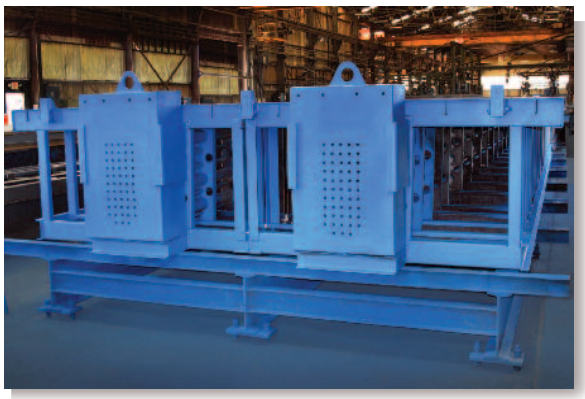
Self-Stressing NEXT Beam Form

J.P. Carrara & Sons, Middlebury, Vermont

Developed as an economical solution for mid-span bridge replacement, the NEXT Beam is similar in shape to a typical double tee. But from the perspective of a form designer, that's where the similarities end.

The first thing to take into consideration is that the NEXT Beam is a bridge beam. Like a bridge beam, it carries a large prestress load. The load is heavily concentrated in the bottom of the stems, verses more evenly distributed as in the stems of a typical double tee; and is designed for .60 strand. But unlike a bridge beam, the strand in the NEXT Beam are de-bonded instead of draped. Draping would have required hold downs or pushdowns in the form resisted by footings under the formwork. The NEXT Beam design team intentionally limited the beam to de-bonding, to allow for casting in a self-stressing bed.

Hamilton Form recently built a self-stressing NEXT Beam form for J.P. Carrara in Middlebury, VT. The form is built for self-stressing up to 2200 kips, whereas a heavily stressed 12-foot double tee form usually has a capacity of 1200 kips or less. The Beam has deck strand and 23 strand densely clustered in each stem. *(Continued on Page 2)*



The self-stressing NEXT Beam form with 12-inch jacking plates.

A four-inch radius forms the stem to deck transition.

A Tale of Two Tees *(Continued from Page 1)*

Solid steel compression bars were used in the self-stressing NEXT Beam form.

The form was split at centerline for shipping and handling considerations.

The NEXT Beam form is designed to accommodate four different stem depths. The varying stem depths are easily accomplished with stem fillers. The challenge for the form designer is designing a form that resists the prestress load at varying centers of gravity. As stem fillers are used to decrease stem depths, the center of gravity moves up from the bottom of the form. The form has to resist the C.G. of the prestress force at approximately 6½ inches above the bottom of the stem for the 32-inch deep beam and 18½ inches above the bottom of the stem for the 20-inch deep beam.

To resist prestress force, a typical double tee relies on a combination of form skin, stiffeners and jacking plates. Hamilton Form typically uses 1/4 inch skin with 1-inch stiffeners and 6-inch gussets on double tee forms. Compression bars are rarely used. However, due to the concentration of strand on the NEXT Beam, six 3.25-inch diameter solid steel compression bars and six skin stiffeners are used in each stem. The compression bars weigh approximately 28 pounds per foot, adding significant weight to the form. A crane was used to lift the bars as a team of men fitted the bar into the form.

Jacking plates for the self-stressing NEXT Beam form distribute the load to the stressing bars at all beam depths. Due to the heavy concentration of strand at each stem depth, 12-inch jacking plates were required. The jacking plates weigh 3,000 pounds each whereas the jacking plates on a typical double tee weigh about 400 pounds.

A 4-inch radius forms the stem to deck transition, while most double tees have a 2 or 3-inch radius or a chamfered transition. Magnetic side rails are used to adjust for different beam widths.

The finished form weighs almost 1,000 pounds per foot and was split at centerline for both shipping and handling considerations. Carrara set up and leveled the form within a few days of delivery. Because the form was split at center, set-up required 3-point longitudinal supports. Hangers were included for steam lines.

Before the first cast, Hamilton Form worked with Carrara to develop a tensioning and detensioning sequence. Carrara measured the installed bed, then, measured how much the bed shortened after stressing. This process helped Carrara make accommodations for movement of the form during stressing. The product stripped beautifully and Carrara was able to meet an aggressive schedule, keeping their first NEXT Beam project on track.

What's New

Dual Median Barrier

Dual line median barrier form with hanging block-out assemblies.

Dual Line Joist Form

Dual joist form with hinge-back notch former and top ties.

Double Tee

Twelve foot flat deck double tee form with 45" stems.

Clearfork Main Street Bridge

Curved soffit and sideforms for haunch girder

The haunch girder formwork includes an arched soffit and 10-foot, 4-inch sideforms.

Haunch girder sideforms with self-stressing bars.

The Clearfork Main Street Bridge is a unique four lane, split bridge that will be built over the Trinity River in southwest Fort Worth, Texas. The bridge will provide a convenient connection between two popular areas of the city. Addressing the concerns of local advocacy groups, the project includes a high-water pedestrian bridge suspended below the vehicle bridge. The pedestrian bridge features river overlooks and ramps that will provide access for bicycles, walkers, runners, wheelchairs, and other users to recreational trails along both sides of the river. The final design satisfied both the technical floodway requirements of the Corps of Engineers and the pedestrian traffic needs of the public. Construction is slated to begin in 2011.

Suspended pedestrian bridge

The precast concrete bridge spans 550 feet with a center span of 220 feet. Texas Concrete Company in Victoria, Texas will be supplying the precast girders for the project, including a 96-foot long haunch girder that is 10-foot deep and tapers to 6-foot at the ends.

Clearfork, Main Street Bridge

The form package includes an arched soffit and 10-foot, 4-inch sideforms. The soffit is formed with a 200-foot radius on one side and a 185-foot radius on the other. The upper flange of the girder has 480 kips of prestress force. Texas Prestress did not want to tie-up one of their main bridge beam beds for the limited number of haunch girder beams required for the project. The abutment at the bed they plan to use is generally used for smaller beams and does not have the capability to resist 480 kips 10-feet in the air. To accommodate this, Hamilton Form designed the sideforms with stressing bars to resist the prestress force in the upper flange of the sideforms. The sideforms also include two pour hatches and a double row of Vibrotrack, one high and one low on one side, and placed in the center of the other set of sideforms. The sideforms are sealed against the soffit with a thru-tie system. Under ties and over center locking top ties complete the form package.

Bridge over the York River on Route 103 in York, Maine.

Beams act as formwork for the deck pour and provide a work platform.

Maine NEXT Beam Projects Take-Off

The Northeast Extreme Tee or NEXT Beam is being met with enthusiasm as transportation officials are becoming familiar with its advantages for medium span bridge replacement. The NEXT Beam width varies from eight to twelve feet, making it wider and more efficient than a typical precast concrete beam section. Beams butted together are designed to support the weight of a cast-in-place concrete deck, eliminating formwork in the field and acting as an instant work platform. And, utilities can run between the stems of the tee, making it easier for installation, inspection and repair.

Two projects in Maine are currently underway using the NEXT Beam. The first is a 510-foot, seven span bridge crossing the York River on Route 103 in York. W.E. Dailey is the precaster supplying 28 NEXT Beams for the project. To take advantage of existing abutments, Dailey cast the beams in a non-self-stressing form built by Hamilton Form.

The second project is the Elliot Road Overpass in Kittery, Maine. J.P. Carrara & Sons is the precaster. Replacing a steel bridge originally built in the 1930's, the project calls for 7 NEXT Beams and 6 precast curbs. Carrara cast the NEXT Beams in a self-stressing form also by Hamilton Form. The form is designed for a stressing capacity of 2200 kips, requiring twelve 3.25-inch steel compression bars and 12-inch jacking plates. The form was split at centerline for efficient shipping and handling.

As more DOTs recognize the durable, cost-effective solution the NEXT Beam provides to replace aging bridges, call on Hamilton Form to provide your formwork. Hamilton Form has experience producing both self-stressing and non-self-stressing formwork for the NEXT Beam and can offer you a durable, cost-effective solution for your NEXT beam project.

J.P. Carrara & Sons, Self-Stressing NEXT Beam Form

W.E. Dailey, Non-Self-Stressing NEXT Beam Form

Measuring Shrinkage of Self-Stressing Steel Beds

When strand is tensioned in a self-stressing steel form, the form shortens. This shortening must be calculated and compensated for when measuring strand elongation during the stressing operation.

Customers often ask how much their bed will shorten when it's stressed. The simple answer is – *in a vacuum, a steel form will shorten approximately ¾-inch for every 100 feet of bed length.* The problem with that answer is – *we don't live in a vacuum.*

A number of variables come into play when calculating bed shortening. First, bed shortening depends on the type of form and amount of stress on the form. A 500 foot piling form with heavily concentrated strand shortens more than a 500 foot double tee form with a single row of strand.

Next, it's important to know how the bed is anchored and installed. A self-stressing bed should be anchored at the center with the remainder of the bed fastened to prevent lift and sideway misalignment, while allowing the bed to freely move lengthways.

When the bed is anchored at the center, the movement of the bed is split toward each end, eliminating creep in one direction and making it easier to measure shrinkage.

But no matter how the bed is anchored, it will not move freely if there is debris or concrete build-up around the base of the form restricting its movement.

Finally, remember thermal conditions. Both ambient and applied heat have an effect on bed shortening. Wide temperature swings need to be considered, especially when applying heat or steam during the curing process. And, like most materials, steel expands and contracts with heat and cold.

The ONLY way to know how much a bed shortens is to measure it.

Here's a suggested procedure:

1. Before initial stressing, put a reference mark on the bed and on the foundation or something stationary at each end of the bed to establish the starting point.

2. Complete the stressing procedure. Mark the final position of the form. Measure and record the distance between the initial mark and the distance to the end of the bed.

3. This is the measurement you need to compensate for when measuring strand elongation.

TIPS

- Shrinkage can change seasonally, especially if the form is outside. You may have a different calculation in the summer than in the winter.
- Keep the area around your beds clean as not to restrict movement of the form.
- Always take a new measurement whenever pouring a different product in the bed.
- Measure often and record measurements in a log. Record the date, temperature and any other variables so that you understand how different conditions effect the movement of the form.

Kevin Burdette

Purchasing

Kevin Burdette joined Hamilton Form 15 years ago. He began handling transportation and logistics: negotiating freight rates and arranging deliveries. Since then he's moved into purchasing. Kevin buys everything for the company, from steel plate to nuts and bolts, from vehicles and cranes to welding wire and sanding disks – all the way to toilet paper. His negotiating skills and relationships with vendors have benefited both Hamilton Form and its customers.

Soon, after joining Hamilton Form, Kevin met Angela, a young woman from Alberta Canada, whom he married in 1997. They have a 9-year-old daughter, Mackenzie Rae. When not "shopping" for the company, you can find Kevin flying model airplanes. He has competed in pattern and freestyle flying events and is a 3-D freestyle enthusiast.

But Kevin's real passion is music. In 1983, he almost severed the ring finger on his left hand. That near disaster turned into his passion when he began playing guitar as therapy to regain the dexterity in his finger. And, regained it he has. He plays amazing electric guitar. He's played with a number of rock bands in high school and while he was at Texas Tech University. He maintains his dexterity, playing almost every day. Since those rock and roll days, he's traded in the night life for a 9-5 job and a family. Good move Kevin, we're glad you landed at Hamilton Form.

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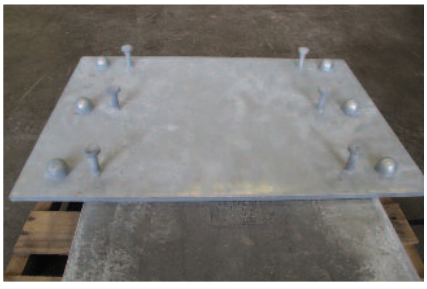
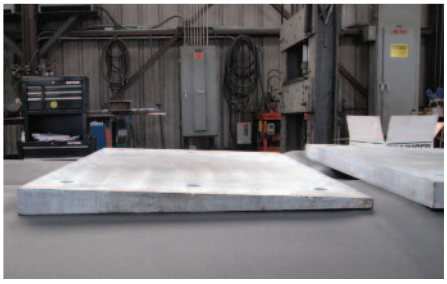
Product News

Galvanized Embed and Beveled Plates

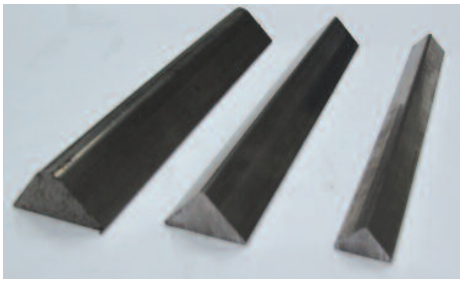




Our machine fabricated galvanized steel, studded embed plates as well as matching beveled plates for both grade and cross slope are precision fabricated to your specifications.

If your project calls for embed plates; call on Hamilton Form for competitive pricing and rapid deliver, 817 590-2111.

Steel Chamfer



Steel chamfer is durable and reusable, making it a good investment for quality casting. Ten foot strips in ½", ¾" and 1-inch sizes are stocked, competitively priced, with volume discounts and usually ship same day. Magnetic chamfer is also in stock.

To order, call 817 590-2111.