FORM+FUNCTION
NEWS & INFORMATION FROM HAMILTON FORM SUMMER 2012

PROJECT SPOTLIGHT

Copano Bay Bridge; Rockport, Texas

VALLEY PRESTRESSED PRODUCTS, INC.

Valley Prestress Products, located in Eagle Lake, Texas, was recently awarded a contract for the prestressed products for the Copano Bay Bridge in Rockport, Texas. The entire project is about three-and-a-half miles long, with a two-mile bridge valued at $78 million.

The prestressed products included TxDOT 63-inch beams for the 150-foot center span, TxDOT 54-inch beams, flat slabs and 54-inch cylindrical piles that vary in length from 83 to 168 feet. Although Valley Prestress has produced precast products for a number of significant bridge and highway projects in Texas and across the south central United States, the 54-inch cylindrical pile was a new product to them. Valley needed new forms to produce the piles, and that required a call to Hamilton Form.

Early and frequent collaboration between Hamilton Form and Valley Prestress was essential in designing the formwork package for this project. The team had to define the optimal bed length and develop a set-up and stripping process so the forms could be designed for the greatest production efficiencies.

The forms were made in multiple segments to allow the bed to be set up and broken down in stages. The piles have a 54-inch outside diameter with a 42-inch voided center. The two-piece outer form consists of a base, permanently installed in the bed, and a bolt-on removable top. Both sections have threaded coil rods bolted to the exterior of the form that act as void hold-up and hold-downs. The headers are also made in two sections, split horizontally. The collapsible interior void is hydraulically actuated. The overall bed is 520 feet long. Outer forms were built in 50-foot sections and the interior voids were built in various lengths to be assembled as needed for different product lengths.

Once form drawings were completed, Hamilton Form built a prototype section of form to prove the geometry and test the hold-ups, void overlap and hydraulics. After testing, the forms went into production. Meanwhile, Valley Prestress was busy getting the bed ready. *(continued)*

54" two-piece outer form

42" hydraulically actuated, collapsible void

Project Spotlight

Copano Bay Bridge (continued from cover)

Void and roller assembly

The longest pile is 168-feet

The ability to set up and pour a 520-foot multi-part bed is a major undertaking. After Valley prepared the bed and installed abutments, a staging area was built adjacent to the bed that included a roller assembly, built to the same height of the product. This would allow the product to be pulled straight out of the form.

After forms were installed, Valley began casting test piles. David Malaer, the general manager at Valley Prestress, explains; "We did extensive research and planning, but once we started our initial casting, the real trial and error began. We refined our processes and discovered the timing of the production sequence is absolutely critical."

The process requires a three-day cycle. On day one the lower headers are set in the bed and the lower strand is pulled to initial tension. Next, bundled spirals are placed at each header. The next step is to slide the voids in place between the bottom form and the spiral. Then, the top headers are dropped into place and the top strand is pulled to initial tension. Next, the spirals are spread out and strand is final tensioned.

On the following day, the spirals are tied and the top section of the form is bolted to the base form. Once the top is in place, the coil rods in the top of the form are tightened to hold the void down and prevent it from becoming buoyant during the pour. The bed is now ready to be poured.

The first pour fills the form just above the halfway point. After the concrete is placed, the bottom coil rods are backed out. The concrete holds the void in place at the bottom while the top rods act as void hold- downs during the final pour. Next, the form is filled and screeded at the top. Shortly thereafter, the top coil rods are backed out of the top of the form. When the concrete reaches preset, the top of the form is removed and the product is water hydrated with wet burlap.

"When adding new equipment in a precast plant'" says David Malaer, general manager at Valley Prestress, "it's smart to choose a supplier you can trust and is experienced. Over the years, we've worked with Hamilton Form on a number of projects. They're true partners; experienced, reliable and fair."

On day three, when the designed release strength of 6300psi is determined, the product is ready to strip. After the bed is de-tensioned, the product, with core and headers, is pulled longitudinally out of the form. Then the core is collapsed and removed on a roller assembly. Next, the headers and excess strand are removed from the product ends. The product is then transported to a curing area and covered with wet burlap for a four-day wet cure.

On the third day, the set-up procedure begins again using a second set of voids and headers, provided so that the next casting cycle can begin without having to wait for the voids and headers to be removed from the last cast piles.

Initial castings revealed some small crazing cracks in the top of the pile at intermittent locations. "The question was; what caused the crazing?" said Malaer, "Was it shrinkage, form movement, mix design, or some combination?" After looking at several scenarios, Valley tried covering the beds with insulated curing blankets, supplied by Hamilton Form. "That solved the problem," explained Malaer. Once the State approved the test piles, Valley was ready to go into full production.

The success of any formwork package is the ability to integrate form design with production practices; and in this case, it was critical. The collaboration between Valley Prestress and Hamilton Form led to a broad and comprehensive understanding of the production challenges that needed to be solved and how the form design could help solve those challenges. Collaboration was the key to the success of this project. Today, Valley Prestress is in the midst of producing and shipping the 460, 54-inch cylindrical piles for the project.

TECHNICALLY SPEAKING

Over Capacity Can Spell Catastrophe

We frequently receive inquiries concerning increasing the maximum allowable force on a self-stressing form. Sometimes this is a result of increasing strand quantities; sometimes it is the result of a design change to a larger diameter strand. Before you even consider adding capacity to your form – call Hamilton Form.

Some small changes may fall within the design safety factor of the form, but you should never make this assumption. It is extremely dangerous to stress beyond the capacity of the form. Exceeding a form's capacity might very well cause buckling at the ends of the form, resulting in form failure and permanent damage. Even worse is the risk of injury or death to personnel working on and around the bed.

Don't be fooled by the misconception that if you use a thicker/heavier jacking plate, the form can handle more load. Load is transferred by the jacking plate to the form skin and stiffeners. Beefing up the jacking plate alone is not always a solution.

When we do evaluate the ability of a form to carry additional load, we do so based on the assumption that the form has been well maintained and is in good working condition. If the understructure of the form is corroded and has not been well maintained or if the form is not properly installed to prevent uplift while allowing expansion and contraction; the integrity of the form will decrease over time. Only you know if your form has been properly maintained. Therefore, it is also important to consider the condition of the form before thinking about adding capacity.

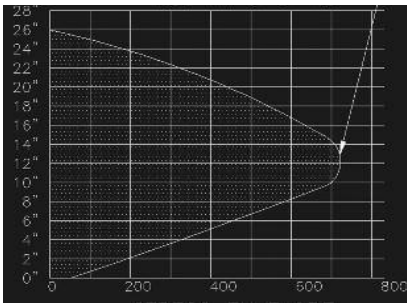
The Stress Envelope

The stress envelope has been used for over forty years in connection with double tees. It shows, in graph form, the overall capacity of the form in kips. It also shows the center of gravity, in inches, as a function of the overall load. For example, if a double tee form is designed for 720 kips at 13 inches; the stress envelope shows 13 inches from the bottom of the stem as the point from which the maximum load of 720 kips can be applied. It also shows the maximum kips at other locations in the stem.

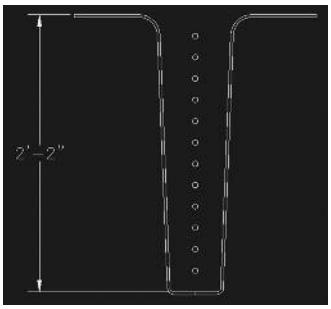
When the stress envelope was originally developed, strand size in use was half-inch; and strand was always placed in a single row in the stem. Under these circumstances, the stress envelope is a very good representation of the form's overall capacity. However, as the design of double tees progressed through the years with new strand placement and strand sizes, the stress envelope has basically remained the same.

If your form was designed for half-inch single row of strand, there are some instances where even though new design criteria may fall within the stress envelope, there is a possibility of over-loading a form. For example; today, strand is frequently placed in double rows in the stem. In this case the load introduced into the form from the jacking plate is much more concentrated. Although the load may fall within the stressing envelope, unless your form was designed for double row of strand, do not assume it is okay to make this change. Double rows of strand concentrate the load in a small area and can cause local overloading of the skin and stiffeners.

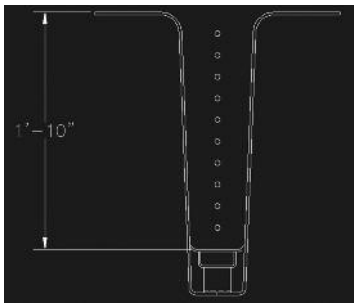
Stem fillers also change the dynamics. Using stem fillers changes the center of gravity of the force, making it important to refer to the stress envelope. Using a stem filler may fall within the stress envelope, but if strand is moved too high in the stem it may not fall within the stress envelope.



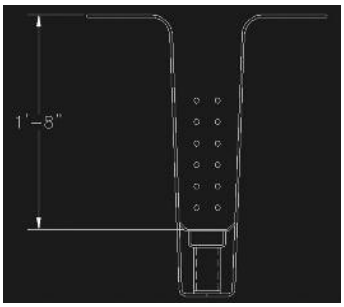
1. **Typical stress envelope for a double tee with 2'2" stems designed for a single row of ½" strand for a total capacity of 720 kips.**



2. **2'-2" double tee stem with single row of strand**



3. **Adding 4" stem fillers moves the C.G. to 15" with 10 strand @ 30 kips each. Total capacity still falls within the stressing envelope.**



4. **Double row of strand with 6" filler. Each stem has 12 strand @ 30 kips @ 13" C.G. Total kips does not exceed the capacity of the form, but the position of the strand will locally overload the form.**

Technically Speaking

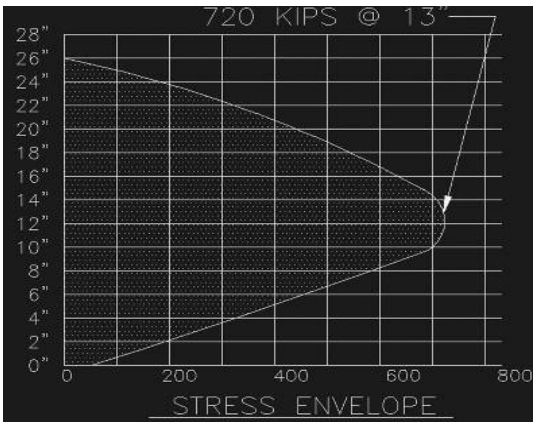
Over Capacity Can Spell Catastrophe (continued)

Changing Strand Size

Never assume it's safe to use six-tenth strand in a form that was designed for half inch strand. Half-inch strand has a design load of 28.9 kips per strand (we round up to 30 kips for simplicity when developing a stress envelope). Low-lax and half-inch special strand loads are up to 34 kips per strand and may fit within the safety factor of the form design.

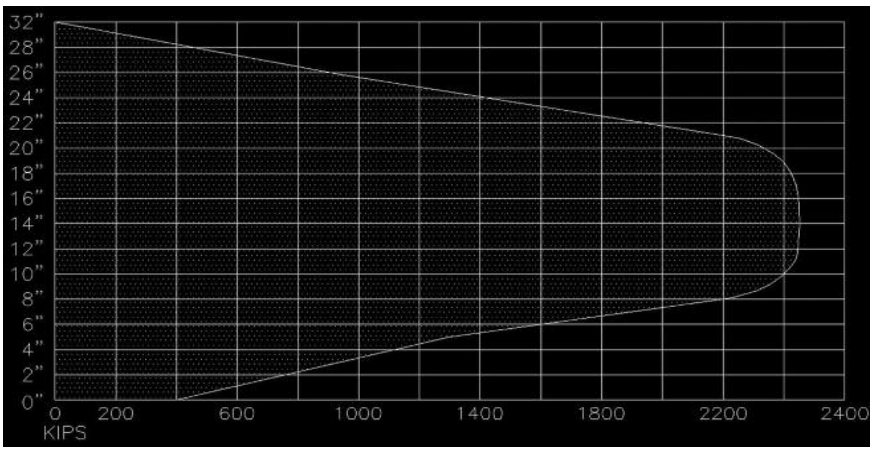
However, six-tenth strand has a design load of 44 kips per strand - almost one and a half times the capacity of half-inch strand. Fifty percent more capacity usually exceeds the form's stressing capacity.

If we go back to the stress envelope for a double tee with twelve half-inch strand and a total capacity of 720 kips, we can easily calculate that a change to six-tenth strand will require a total capacity of 1056 kips, which clearly falls outside the stress envelope.



Stress envelope for form designed for ½" strand and 720 maximum kips. A change to 0.6" strand will definitely overload the form.

Obviously a double tee form can be designed for a double row of six-tenth strand. For example, the NEXT Beam is a double tee shaped, heavily stressed bridge beam. NEXT Beam forms are like a double tee form on steroids. The NEXT Beam has an overall capacity of 2400 kips with twenty five six-tenth strand in each stem. To carry the load, a minimum of three-inch compression bars, heavy stiffeners and twelve-inch jacking plates are used. Because the stem depth can vary from twenty four to thirty six-inches, compression bars are used at multiple locations in each stem. The stress envelope for the NEXT Beam looks significantly different from that of a typical double tee.



Stress envelope for NEXT Beam form, designed for double row of 0.6 strand and 2400 maximum kips.

Maintenance Practices are Critical to Performance

There are certain conditions to be aware of that could result in the reduction of the stressing capacity of a form. Any reduction in the form stressing capacity is very crucial when evaluating the impact that increased strand size or number of strand could have on the ability of the form to carry additional load. Some factors to be aware of are:

- Corrosion of the form skin and/or understructure.
- Uneven bearing of jacking plates at the end of the form.
- New or enlarged holes in the jacking plates that were not approved in advance by your engineering department or form supplier.
- Forms that have not been properly anchored to the foundation to prevent uplift and at the same time allow the form to expand and contract longitudinally.

All forms should be periodically inspected to ensure they are kept clean and properly maintained so they will continue to perform as intended.

Before making any changes to the capacity of the form – first call Hamilton Form.

Designing a Self-Stressing Form

To design a self-stressing form, the engineer needs to know not only the capacity of the form, but how the load will be distributed. In the case of a double tee, if the load is concentrated at the bottom of the stem, extra or larger stiffeners will be used in that area of the stems.

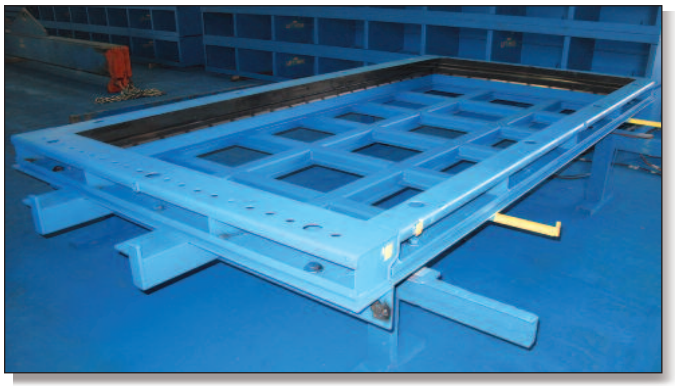
If a double tee uses stem fillers, the stems will be designed to accommodate changes in the center of gravity. There are differences in designing a double tee for a single vs. a double row of strand. That's why we always ask for a strand pattern and the size of strand in addition to the overall load to design a self-stressing form.

The more knowledge we have of what you want to do with your form – now, and in the future, the better equipped we are to design formwork that will deliver years of profitable service.

FORMWORK

Median Barrier & Retaining Wall Forms

Adjustable, dual-line median barrier



Retaining wall forms

Median Barrier Forms

Concrete median barriers, known for their relatively low life-cycle cost, effective safety performance, and maintenance-free characteristics, are the most common type of rigid median barrier in use today.

Most median barriers are a standard designs. Forms may vary by being single or double cavity molds. Pictured is a dual line median barrier form that is unusual because it is an adjustable form designed to produce two different product widths. The form has a fixed center with a bolt down sideform on each side. The sideforms can be unbolted and repositioned on the base plate to produce a wider product. A set of internal headers were produced for the two different product sizes. Adjustable top ties and bolt on external headers complete the package.

Retaining Wall Forms

Small forms are often the most intricate. These 5-foot wide by 10-foot long "window pane" forms are used to produce retaining walls. They consist of a frame with keyed rails and outriggers. The mirrored, keyed rails form the interlock between adjacent concrete panels, and the outriggers provide rail storage during stripping.

A textured mat is placed face up in the form and fits snugly against the chamfer on the bottom of the rails. The mat is screwed to the frame from below. Anchors protrude above the top of the concrete and are held in place with a locking adjustable anchor retaining bar. The anchor retaining bar provides maximum flexibility in positioning the anchors while locking them in place during pouring. Hamilton speed bolts round out the system providing for quick and easy striping and subsequent set up.

EMPLOYEE PROFILE

Ben McWherter

Shipping and Receiving

If you have received a shipment from Hamilton Form in the past several years, you probably recognize Ben's name. Ben handles shipping and receiving at Hamilton Form. He negotiates freight rates, schedules shipments and notifies customers by e-mail when the shipment leaves our dock. Ben is essential in maintaining good communications with our customers, so you know when to expect your new forms or equipment. In addition to shipping, Ben handles receiving. So whether it's in the door or out the door - Ben's our man!

When Ben heads out our doors, he heads home to spend time with family and friends. His little girl Lily, who will soon be 4, keeps him busy. Lucky for wife Jessica, Ben loves to cook. He also enjoys baking and finds that Lily is always willing to help – especially when it involves sprinkles.

Ben's 12-year old son Zack lives in Iowa with his mom, but enjoys coming down to Texas to spend the summer with his Dad. Ben enjoys spending time outdoors and being active; maybe that's why he's so happy keeping things moving at Hamilton Form.

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PRODUCT NEWS

Double Tee Stem Cleaner

Improve overall productivity by mechanizing one of the industry's most labor intensive operations with the double tee stem cleaner.

The Double Tee Stem Cleaner, a daily maintenance tool, targets one of the most difficult areas to reach for cleaning. It should be used after every casting to remove concrete debris from the form. Daily cleaning helps prevent heavy build-up, produces a better finish and makes product easier to strip.

The machine is self-contained, rides easily on the form, is easy to transport and features:

- A Honda electric start 10.2HP engine
- A cone shaped brush custom configured to fit the stem width and depth of your double tee
- Strong nylon filament brushes encapsulated with a special abrasive grit for efficient cleaning and long wear
- Easy to remove brush assembly allows for the attachment of different brushes for use on multiple double tee beds

For more information call 817 590-2111 or e-mail: sales@hamiltonform.com