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## MAGAZINE

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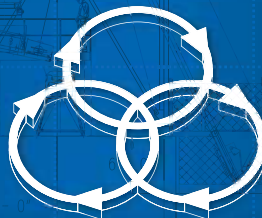
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# 7 Views from the Top

BY TOM ENGELMAN | *Chairman, National Precast Concrete Association*

It's hard to believe, but it's already been seven-plus months since I accepted the gavel last October in Coeur d'Alene, Idaho. In honor of that, I've put together seven observations I've made so far as Chairman of the NPCA Board of Directors.

1. I've always known NPCA is a family, but it's a far bigger and closer family than I ever realized. In my acceptance speech, I talked about some of the people in the NPCA family who have been influential on my career. As chairman, I've seen just how many of these types of close relationships there are and how much they mean. Not only does NPCA help us advance the industry, it also creates lasting friendships and business contacts that have surpassed generations.
2. Speaking of generations, there's a new one beginning to earn its place at the table in this industry, and that's exciting. My father, Al, started Bethlehem Precast, and I was honored to take it over when he retired. I hope to leave my sons with a company they are proud to be a part of. I see the same thing happening everywhere: a new generation poised to take over the reins or that already has done so. These young men and women have a fresh perspective and lots of energy and ideas. I fully believe they will lead our industry into the future with great success.
3. There's a lot more to be gained from an NPCA membership than many of us realize. I attended my first NPCA Convention with my father in 1992. Since then, I've participated in various roles over the years, culminating this year as chairman. While I've always known NPCA has a lot to offer, I never realized quite how much until this year. I encourage all of you to take advantage of the full range of educational opportunities, meetings, volunteer positions, online resources and more.
4. We may be operating in a less-than-perfect economy, but our association has remained solid. Many other associations are operating in the red or diminishing their offerings, but NPCA is financially stable and continually growing its programs.
5. In Idaho I mentioned that Mike Loy, a 26-year employee of mine, was close to receiving the Master Precaster designation. I'm proud to say he earned it at this year's Precast Show. Throughout the 10 years Mike worked on that endeavor, I watched how he was growing as a professional in my plant and it made me proud. As chairman, my eyes have been opened to the benefits of the program from a much broader perspective. It's advancing employees throughout our industry and, as a result, advancing our industry.
6. All of the volunteer positions we fill are more critical than I ever imagined. I've held many roles and always hoped I was helping to accomplish good things, but I now realize just how important that work is to the association and the industry. So to everyone who has volunteered in the past or is currently in a position, I want to say Thank You. If you are thinking about becoming more involved, I encourage you to do so. It's a decision you'll be glad you made.
7. Lastly, and maybe most importantly, I'd like to quickly address what I think are the keys to the future of our industry. It's been a tough four-plus years for most of us, and I think the industry has changed more in that time span than it did in the prior 15-20 years. As precast concrete producers, we need to remain focused on quality, adaptation, and expanding our industry to new products. We all know the benefits of precast concrete, but it's our job to get others to realize them as well.

**As precast concrete producers, we need to remain focused on quality, adaptation, and expanding our industry to new products.**

I look forward to the final four-plus months of my tenure as chairman of this association and to the future of our industry, because I know good things are around the corner. ■

Tom Engelman



## COVER STORY

# Advance Concrete Products

Representing all the employees at Advance Concrete Products, Highland, Mich., from left to right, are Steve Kirchner, vice president of production; Mike Demeester, plant superintendent; Lauren Sustic, production engineer; Bob Husak, sales; Gregory Pollard, vice president; and Rick Kirchner, president. The company owes its success, through good and lean times, to its people.

Photo by Ron Hyink

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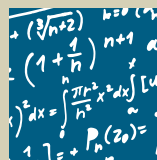
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# Formwork Maintenance Determines Precast Concrete Product Quality

New forms are a capital expense and often put on the back burner. When dated formwork is not replaced, the need to properly maintain, inspect and store old formwork becomes crucial.

BY BRYAN COUSINO, P.E. | PHOTOS COURTESY OF SPILLMAN CO. ([www.SpillmanForm.com](http://www.SpillmanForm.com))

Under the gun and in a flurry of non-stop movement, a precast concrete production crew preps forms to meet an impending deadline. Old caulking remains on one of the panel forms before the pour. What is the result? Production meets the client's deadline but at the cost of a poor finish and product appearance. This precast company's reputation slips a notch, because most people, not just owners and contractors, judge the quality of a precast concrete product in large part by its outward appearance.

This article lists the required daily and monthly inspections and the correct way to prep, store and level forms to ensure a good-looking concrete finish that will protect your company's reputation for quality products.

## Formwork inspection items and frequency

### Daily inspections

1. Weld inspection – inspect for separation, cracking and bending:
  - a. Lifting loops
  - b. Trunnions
  - c. Vibrator mounts
2. Casting surfaces – inspect for cleanliness and defects (blemishes in the skin, pitting and rust)
3. Chamfer – inspect for alignment and general damage
4. Springs, hinges and moving parts – confirm proper operation and range of motion
5. Shims – confirm all shims are in place

6. Trueness of level – inspect using a level or surveying equipment on formwork each time it is removed from the slab

### Monthly inspections

1. Weld inspection – inspect for separation, cracking and bending:
  - a. Chamfer
  - b. Form components (hinge plates and clamped connections)
  - c. Connection of reinforcing structure to form skin
2. Trueness of level – inspect with a level or surveying equipment on forms that are permanently anchored to the floor
3. Anchors to floor slabs – inspect
4. Signs of rust (under structure) – inspect twice monthly on forms subjected to accelerated curing

### Formwork maintenance prior to storage

1. Remove any built-up concrete on the form, paying particular attention to the casting surfaces.
2. Coat form with a weatherproof rust inhibitor (form oil is not a suitable long-term rust inhibitor). Most rust inhibitors must be reapplied every six months (three months in marine environments).
  - a. Coat internal parts (pallets, headers and bulkheads) and moving components (hinges, clamps and rollers) with suitable grease or rust inhibitor.
3. Inspect painted surfaces and re-coat as necessary.
4. Store on a flat, level surface with appropriate hardwood dunnage; typically, supports on 5-ft increments are adequate.
5. Keep forms from high-traffic areas and exposure to the elements.
6. Do not let standing water collect on the form.
7. Cap ports on hydraulic cylinders and retract cylinders to avoid rust and pitting.
8. Inspection – Form storage is a good opportunity to do a thorough form inspection. Signs of rust on the contact surfaces should be removed by sanding or grinding. Never sandblast the casting surfaces. Signs of rust on non-contact surfaces can be removed by sanding, grinding or sandblasting (always use a NIOSH-approved respirator when sandblasting). Be sure to protect all surfaces, as rust forms rapidly on unprotected steel surfaces.

### Proper leveling of formwork

A form that is not adequately leveled can cause nonconformances in casting tolerances, improper form operation, difficulty in stripping and damage to the casting or form components. Forms should be installed on a flat surface capable of supporting the form. It is never recommended to install a form on a gravel surface.

Forms less than a 6-ft maximum casting dimension can generally be leveled with a 4-ft level. Forms greater than 6 ft may need to be shot in with a laser level. Forms are produced



CHECK VIBRATOR MOUNTS, SPRINGS, HINGES AND MOVING PARTS FOR PROPER OPERATION AND RANGE OF MOTION.

on a level surface, and as little as 1/16 in. in variation can cause performance problems in certain forming applications. These problems are compounded the taller and longer the form. A 1/16-in. variation in levelness at the bottom of a form that produces an 8-ft-tall product can cause a 1/4 in. or more variation from specifications at the top of the form.

It is important to check the levelness of a form to the casting surfaces. Structural elements used for reinforcement have mill tolerances in excess of typical precast and prestressed castings and cannot be used as reference points for leveling a form. Additionally, these steel mill tolerances may cause the bottom of the form to vary and should be shimmed as necessary to level the casting surfaces.

In conclusion, older formwork can remain in service to produce a quality precast concrete finish as long as these inspection and maintenance guidelines are rigorously followed. ■



*Bryan Cousino, PE., is engineering manager at Spillman Company in Columbus, Ohio. He is responsible for formwork design and is the primary contact for technical questions on installation, performance and form maintenance. Contact him at [bcousino@spillmanform.com](mailto:bcousino@spillmanform.com).*

## PART 4

# Top Precast Plant Operational Deficiencies

A staff engineer reports on pre-assessment audits for the NPCA Plant Certification Program.

BY EVAN GURLEY

**Editor's Note:** In the first two parts of this four-part series, we addressed 10 of the most common problems encountered during a typical pre-assessment plant inspection relating to Chapters 1 through 5 in the NPCA Quality Control Manual for Precast and Prestressed Plants. In parts three and four of this series, we are focusing on product-specific deficiencies relating to Chapter 6, "Special Requirements," of the NPCA QC Manual. The first three parts of this series were published in the January-February 2012, March-April 2012 and May-June 2012 issues of Precast Inc.

## 14 Step Testing

Side-stepping the requirement detailed in Chapter 6 of the QC Manual will land you a deficiency for products that are designed with steps cast into the product. Deficiencies are far too common with this requirement, as the specifics are often not fully grasped.

The NPCA QC Manual states:

*"Step vertical and horizontal load testing must be performed according to the applicable section(s) of ASTM C497 once per year, per step design used and whenever a new step supplier is used. The step testing must be performed in the precast plant in the product for its intended use. The testing must be performed or witnessed and results documented by a member of the precasters Quality Control Department. The loads achieved must meet the requirements of ASTM C478."*

This requirement is clearly laid out in the applicable sections in the NPCA QC Manual, but deficiencies in these sections are common.

The mix-up occurs with the actual in-plant testing of the step in its cured state. Just like any other material cast into a concrete product, from aggregates to reinforcing steel to rebar

STEPS THAT ARE CAST INTO THE PRODUCT NOT ONLY MUST COMPLY WITH INDUSTRY STANDARDS, BUT THE INSTALLED STEPS MUST BE TESTED FOR VERTICAL AND HORIZONTAL LOADING.



NPCA file photo



chairs and spacers, the manufacturer/supplier of that product will provide a certificate or data sheet to indicate which industry standards the material is in compliance with. The precaster will see this certificate/data sheet that comes along with the steps and see that the step itself meets the industry standards (ASTM C478 and OSHA). The precaster will then assume that the specific requirement is met. This is a common error.

While the step itself may meet the applicable industry standards, the performance of the installed step must also be checked, in the form of a horizontal and vertical pull-out load test (400 lbs horizontally, 800 lbs vertically), per ASTM standards. This test is required once per year, per step design used and whenever a new step supplier is used.

## 15 Watertightness testing

This typically straightforward test often results in a deficiency. The frequency for performing watertightness testing for septic tanks is outlined in Section 6.5.2 in the *NPCA QC Manual*:

*“Tank watertightness testing shall be demonstrated according to the acceptable section(s) of ASTM C1227 or the requirements set forth by the authority or authorities having jurisdiction, whichever is more stringent. A minimum of one test per year on a septic tank produced in each septic tank form used at the plant shall be performed and documented. If the authorities having jurisdiction require a greater frequency of testing, the plant shall maintain records of all additional tests at the plant.*

*Forms producing tanks that fail watertightness testing must undergo additional testing commencing with the next production of tanks from the form and continuing until 10 consecutive tanks pass the test.*

*In cases when multiple tank sizes are manufactured using the same form, watertightness testing should be performed on the largest (tallest) structure, as long as the same reinforcement design and concrete strength are used. Otherwise, testing should be performed on each individual tank design.”*

For this requirement, deficiencies result from the lack of testing tank forms. The requirement in Section 6.5.2 in the *NPCA QC Manual* clearly states that a watertightness test is required one time a year per tank form that is used in production, unless a failure in the tank is discovered. In that case, additional testing is required.

Many deficiencies occur when the precaster has multiple tank forms but manufactures only one size. The precaster will claim that only one tank needs to be tested, because the tank forms are the same size and are from the same manufacturer. This is a common mistake. Even if the precaster manufactures one standard size and has more than one tank form, each tank form will need to be tested for conformance.

Watertightness testing of a tank produced in each form is necessary to ensure that all forming equipment remains within the appropriate tolerances. Keep in mind that this is a critical requirement when manufacturing septic tanks, and the plant must receive a passing score (> 75%) in order to pass the plant certification audit.

## 16 Dimensional checks

Dimensional checks show up in Sections 6.2, 6.3, and 6.4 in the *NPCA QC Manual*, as well as in the deficiency column on a plant inspection grading schedule. In addition to the standard post-pour dimensional checks required for products that fall under Sections 1 through 5 in the *NPCA QC Manual*, pipe, manhole and box culvert post-pour dimensional checks require more in-depth documentation.

The *NPCA QC Manual* outlines the following dimensional checks for precast concrete **pipe**:

*“At a minimum, dimensional checks shall include internal diameter, wall thickness, and length of two opposite sides (measured directly across from each other). Joints must be checked for dimensional conformance with the manufacturer’s specifications, applicable standards, and/or specifying authorities.”*

The *NPCA QC Manual* outlines the following dimensional checks for precast concrete **manholes**:

*“At a minimum, dimensional checks shall include: manhole internal diameter, wall thickness, height of two opposite sides, verification of hole locations and size (when applicable), and verification of the invert dimensions and elevations (when applicable).”*

The *NPCA QC Manual* outlines the following dimensional



CORRECT DOCUMENTATION OF DIMENSIONAL CHECKS CONSISTS OF MARKING DOWN THE ACTUAL RECORDED DIMENSIONS AND COMPARING THEM WITH THE DIMENSIONS ON DETAIL DRAWINGS.

checks for precast concrete **box culverts:**

*"In addition to standard post-pour inspections required in Section 4.6.4 of this manual, the plant shall also specifically check critical product dimensions including top slab, bottom slab and wall thicknesses, and inside length, width and height. These dimensional checks shall be performed on at least one box culvert produced in each form per day."*

These additional dimensional checks are a requirement for the manufacture of pipe and manholes and a critical requirement for box culverts. Dimensional checks of box culverts are to be performed on at least one box culvert produced in each form per day. Pipe and manhole dimensional checks are to be performed on a minimum of three pieces/sections or 3% of each day's production, whichever is greater, chosen randomly by plant quality control personnel.

Deficiencies occur when plants do



NPCA file photo

not perform the additional dimensional checks altogether; do not meet the three or 3% requirement; or fail to perform and keep on file the detailed checks. Too often, post-pour dimensional checklists will be full of check marks indicating that the actual dimensions meet the dimensions on the detail drawings. Inspectors are looking for more in-depth records than simple check marks on a grid. Correct documentation consists of marking down the actual recorded dimensions and comparing them with the dimensions on the detail drawings to ensure that the product is within the specified tolerances.

Keep in mind that these additional checks are not only for the inspector's reference when inspecting a plant; they should also be reviewed by plant personnel to ensure the forms, forming equipment and production processes are able to achieve a certain level of consistency and quality.

**Conclusion**

For the most part, precasters do a great job preparing their plants for the initial inspection audits and continuing similar production practices and quality control measures going forward. For plants looking to get into the certification program or looking to improve upon their current inspection grade, one of the biggest tools they have at their fingertips is the *NPCA QC Manual, Version 9.0*. The QC Manual outlines in detail every requirement and the frequency for performing or documenting a procedure or material. It is available as a free download from NPCA's website at [precast.org](http://precast.org). If for some reason any requirement is unclear to plant personnel, they have a great resource in the technical staff at NPCA to resolve any concerns. ■

*Evan Gurley is a technical services engineer with NPCA.*



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# Get More from Your Mix – for Less

New material technologies and intelligent mix designs can significantly decrease production and labor costs.

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BY CHRIS VON HANDORF, P.E.

Reducing material and labor costs makes sense for any manufacturing company, and increasing profits is even more imperative during a slumped economy. Companies in every industry have been forced to look at ways to lower production costs to remain competitive in our rapidly evolving marketplace. The precast concrete industry is no exception.

Concrete constituents are only a portion of the costs incurred by a precast concrete manufacturing facility. This article shows how a smart mix design can help you cut costs. The important point to remember is that a lower-cost concrete does not always result in an inferior product. In fact, in some cases, lowering the cost of your mix design may actually yield a higher-quality concrete product.

### Cost of concrete constituents

As you know, concrete is created by mixing coarse aggregates, fine aggregates, cement, water and any number of various admixtures to improve its fresh or hardened-state properties. For the sake of discussion, let's assume that we are working with 1 cu yd of a standard, 5,000 psi-compressive strength concrete with the mix constituents shown in Table 1.

As can clearly be seen in the table, cement is the most

costly material per ton and also makes up about 60% of the cost for the mix design. Since cement is the most costly mix constituent, it makes sense to start here and try to reduce the amount of cement.

### Aggregate shape and size affect the bottom line

One of the best ways to reduce the amount of paste (cement and water) required is to optimize the aggregates. Aggregates

TABLE 1.

	Weight (in lbs)	Cost per ton	Cost per yard of concrete
Water	305	\$1.00	\$0.15
Cement	762.5	\$110.00	\$41.94
Fine aggregate	742	\$20.00	\$7.42
Coarse aggregate	1900	\$20.00	\$19.00
Cost of mix/cu yd			\$68.51

*Note: The cost per ton for the materials listed is based on averages taken from multiple sources and is used only as a reference, not as an accurate current cost of any material.*

can be optimized for a variety of properties. One way to optimize aggregates and reduce the amount of paste required in a given mix is to have the lowest surface area-to-volume ratio possible. A lower total surface area of aggregates means less cement paste will be required to cover the aggregates. Less cement paste equals less cement, which means lower material costs.

**Surface Area-to-Volume ratio = Surface Area / Volume**

When looking at your mix designs, it is important to use the maximum aggregate size practical for the application. Larger aggregates will inherently have a lower surface area-to-volume ratio than smaller aggregates. Section 6.3.2 of ACI 211.1, "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete," discusses the considerations and limitations for maximum aggregate sizes.

Round or cubical-shaped aggregates have the highest volume with the lowest possible surface area. Conversely, angular-shaped aggregates, such as crushed aggregates, have a higher volume-to-surface area ratio. Therefore, angular aggregates will require additional cement paste compared with similarly sized round or cubical aggregates. More cement paste means more cost. Additionally, with all other factors equal, concrete using angular aggregates will have a lower workability compared with concrete using round or cubical aggregates. And lower mix workability may lead to additional concrete placement costs (labor).

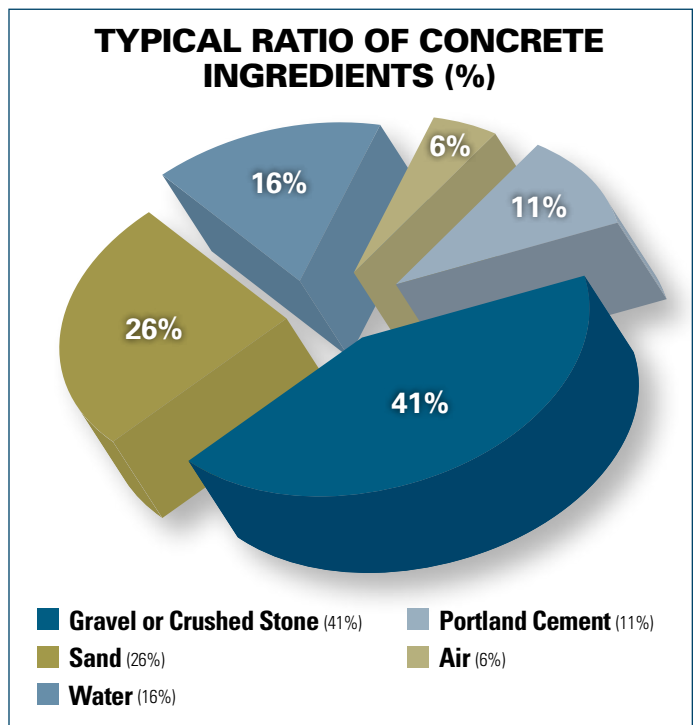
**Aggregate packing factor affects cement content**

Another important factor to consider when trying to reduce the amount of cement paste is the aggregate packing factor. The aggregate packing factor is defined as:

$$\text{Aggregate Packing Factor} = \frac{\text{Volume of Aggregates}}{\text{Volume of Aggregates} + \text{Volume of Voids}}$$

A good way to understand this is to visualize a container full of coarse and fine aggregates. Fill the container with water until no more water can penetrate the aggregates. The aggregate packing factor is the volume of the container minus the volume of water divided by the volume of the container. The less water that fits into the container, the higher the aggregate packing factor. If the water that was poured into the container had been cement paste, the more cement paste that is required, the more expensive the mix. Therefore, when looking to decrease cost, it is desirable to use aggregates with the highest achievable packing factor in order to decrease the amount of cement paste.

ASTM C33, "Standard Specification for Concrete Aggregates," provides excellent direction to aggregate producers as well as concrete manufacturers regarding optimal gradations for aggregates used in concrete materials. In addition to providing aggregates recommended by ASTM C33, many aggregate suppliers will also include the aggregate packing factor. When



used properly, this information can help you obtain aggregates that require the least amount of cement paste per mix.

Besides decreasing costs, it is generally accepted that minimizing the amount of cement paste produces a concrete mix with better durability and reduced shrinkage. Decreasing the cement paste in your product is not only a cost-cutting technique, but the cement reduction will also improve the quality of your product.

**Admixtures offer many cost-saving options**

The cost of the materials that make up concrete is but one of the many expenses incurred by a precast concrete manufacturing facility. Another major expense is the labor cost to place and finish the product. This cost varies widely depending on a plethora of factors including: the type of product; the climate; the experience level of workers; and reinforcement required.

Here are just a few of the admixtures available that, in the right application, have the potential to significantly lower production costs:

- 1. Supplemental Cementitious Materials:** The use of supplemental cementitious materials, such as silica fume and blast furnace slag, has the potential to enhance the performance of concrete while reducing any bleeding that may occur. When used properly, silica fume can improve concrete's resistance to chemical attack. It can also increase concrete strength while reducing the permeability of the concrete. And given the fact that silica fume is a recycled byproduct of the energy industry and is considered a cementitious material, it is often relatively inexpensive and



THE USE OF ADMIXTURES AND APPROPRIATELY SIZED AGGREGATES CAN SIGNIFICANTLY LOWER PRODUCTION COSTS.  
 Photos courtesy of Portland Cement Association

may reduce the amount of cement required in a given mix design.

**2. Accelerators:** The use of accelerators in precast applications has some obvious advantages. The faster concrete reaches the required stripping strength, the quicker the forms can be cleaned, prepped and used again. For a precaster, a quicker strength gain is huge if you are looking to go from pouring once per day in a given form to twice per day. Pouring forms

twice per day will translate into the economy and flexibility of double production quantities, expansion to different product lines, and reduction in total days and labor costs for production.

**3. High-range water reducers:** High-range water reducers (HRWRs) are excellent for nearly every precast concrete application. A good high-range water-reducing admixture will allow you to produce concrete batches with more consistent air entrainment and more consistent ultimate strengths. HRWRs decrease cement content and allow a corresponding decrease in mix cost. HRWRs also allow for greater concrete workability with a decreased water-to-cement (w/c) ratio. Lower w/c ratio produces a higher-quality concrete product while decreasing the labor required for placing and finishing.

**4. Release agents:** While release agents are not a constituent of the mix, the use of a high-quality release agent is essential for a better-looking, lower-cost, finished product. As with HRWRs, release agent technology has improved significantly in recent history. Although many new release agents are more expensive per unit, most of them do allow for a lighter application than traditional release agents. As a result, the cost per square foot of coverage is often significantly lower using the newer form release agents.

Emerging technology and processes surrounding the concrete industry are rapidly advancing. Admixtures that cost only \$1 to \$2 per cubic yard may have the potential to save you hundreds of dollars or more in labor and rework. Many of these admixtures were not available a few years ago. Some material testing techniques that were not available years ago, or were very expensive, are now relatively inexpensive. Therefore, it is no longer economical or wise to continue precast production methods with a familiar, long-standing mix design simply because it has been the traditional way of doing things for the last 20 or 30 years. ■

*Chris Von Handorf, P.E., is a technical services engineer with NPCA.*

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ENVIRONMENTAL INSPECTORS ARE TYPICALLY WELL VERSED IN SEVERAL AREAS OF REGULATIONS AND MAY INSPECT FOR WATER QUALITY ISSUES, HAZARDOUS MATERIALS ISSUES AND OTHER REQUIRED COMPLIANCES.

# How to Prepare for and Survive Environmental Inspections

BY DOUGLAS E. RUHLIN | PHOTOS COURTESY OF RESOURCE MANAGEMENT ASSOCIATES ([www.rmagreen.com](http://www.rmagreen.com))

**H**ave you ever undergone an environmental inspection by a representative of a government agency, such as the U. S. Environmental Protection Agency (EPA), your state/province environmental agency, or a local agency? It may have been a nerve-wracking experience, or perhaps you received a negative report or even a penalty or fine.

So how can you prepare for an environmental inspection, and what can you do to ensure it goes well? This article will answer some of the questions you may have regarding environmental inspections, and will provide some tips and guidance to ensure your inspection goes smoothly.

## What is an environmental inspection?

An environmental inspection is an investigation of either your level of compliance with an environmental regulation or permit,

or of a perceived noncompliance or a complaint.

If your precast plant has an environmental permit of some kind (such as an NPDES<sup>1</sup> stormwater discharge permit, or an air quality permit), you can expect to be inspected at some point for the duration of that permit (typically five years). Inspections are also possible before a permit is issued or after it expires, and they may occur several times.

Another reason you might be inspected is because of a complaint about the environmental conditions or operations of your plant. For example, a neighbor may complain about dust from your plant, runoff from your plant site, excessive noise or any other issue, whether it is valid or not. It is the inspector's job to determine the validity of the complaint. Or possibly environmental inspectors may suspect noncompliance at your plant on the way to some other site and make an unannounced

visit to see if you have the required permits and approvals.

### **What will be inspected?**

Usually, environmental inspections by an outside regulatory agency are focused on one issue such as compliance with your air permit. As such, inspections tend to be somewhat limited in scope. However, it is not uncommon that an inspector is well versed in several areas of environmental regulations, and he or she may also inspect for water quality issues, hazardous materials issues and other required compliances. Or if a pattern of noncompliance or problems is found, the inspector may come back at a later date with additional personnel to conduct a thorough, comprehensive inspection of a variety of environmental regulatory issues.

### **Can I refuse an inspection? When will an inspection occur?**

When you ask for an environmental permit or approval of some type, the approval typically comes with a condition that grants the regulatory agency the right to inspect your operation. However, there may be some circumstances in which you have legal rights to require some form of legitimate authorization to conduct an inspection of your facility. If this is the case, you're usually in a serious situation.

Inspectors tend to limit visits to normal working hours, although they have the right to inspect at any time and unannounced. The best strategy is to assume that an environmental inspection can occur at any time. And unless you have an overridingly sound reason to do so, it's probably not a good idea to contest an inspector's authority to conduct an inspection. As always, when in doubt, seek qualified legal counsel beforehand with regard to permissible access to your site.

### **Who can conduct an environmental inspection?**

Environmental inspections usually are carried out by representatives of environmental regulatory agencies, such as a state/province environmental agency or the EPA. There may be one inspector or several working as a team. Within reason (compliance with safety considerations, for example), they can inspect what they want, when they want.

At all times, environmental inspectors at your facility should be accompanied by a plant staff member. When inspectors arrive at your plant and request an inspection, you should always review their credentials. Every government inspector will have some form of government identification or a business card at minimum. Allow only authorized government inspectors to conduct inspections on your property and not local citizens, members of environmental groups or others without appropriate prior knowledge and informed consent on your part. Again, you may wish to consult legal counsel before these types of visits are made. Remember, government regulators may have certain rights to inspect your property for compliance with environmental permits or approvals, but most non-regulatory individuals do not have this right.

### **What will inspectors look for?**

Environmental inspectors will look for everything that pertains to the regulatory permit or approval in question. For example, when conducting an NPDES stormwater discharge permit, an inspector will likely review all paperwork and documentation related to your permit, such as a copy of a Stormwater Pollution Prevention Plan and your Discharge Monitoring Report submittals. Then, a thorough inspection of site conditions and outfall locations (ditches, swales) will likely occur. An inspector typically will make notes and may take photographs.

### **Will I know the results of the inspection right away?**

At the conclusion of the inspection, inspectors may verbally summarize their findings, although they are under no obligation to do so. You may have to wait until you receive a written report summarizing inspection findings. If a problem is found, you may be issued a field Notice of Violation (NOV) at that point, or one may show up later. There are certain legal issues involved with the receipt of a field NOV, such as who should receive it, who should sign for it and whether it can be refused. Invariably, if an NOV is going to be issued, it will arrive through proper legal channels; again, another instance where consulting legal counsel (before inspections) is advisable.

### **What should I do during an inspection?**

First of all, remember that environmental inspectors from a governmental agency are professionals doing their jobs and that they are human too. Everyone wishes to be treated professionally and courteously, so ensure that you treat visiting inspectors with proper regard. Be helpful and courteous. You are under no obligation to guess or speculate on anything, so answer only what you know. If you don't know the answer, confirm that you will find it in a timely manner and forward that information to the inspector as soon as possible. Provide the inspector with what he or she requests, but don't provide unnecessary or extraneous information.

During the course of an environmental inspection, stay with the inspector and take note of what he or she observes. You may wish to take your own set of notes during the inspection, including any summary remarks, and take duplicate photographs or samples if the inspector does so (this material may prove useful in the future should an NOV be issued). And don't neglect safety issues – if you normally wear full personal protection equipment (PPE) during the course of your job function, wear it during the inspection and request that the inspector do likewise. If the inspector does not have appropriate PPE to wear during the inspection, provide it. Remember, your job is to manage the inspection in a professional manner, and hopefully to conclude it in a timely and successful manner.

### **What can I do to ensure that an inspection goes smoothly?**

The No. 1 thing you can do to ensure your inspection goes smoothly is to make sure you are in compliance with all applicable environmental regulations that pertain to your





INSPECTORS MAY VERBALLY SUMMARIZE THEIR FINDINGS, BUT THEY ARE UNDER NO OBLIGATION TO DO SO.

precast plant. Overlook nothing! It is absolutely critical to be in compliance. If you don't have the expertise on staff to ensure that the facility is in compliance, seek qualified assistance from an experienced environmental professional and/or legal counsel who will perform an environmental audit of your plant.

As part of your overall compliance program, ensure that you and your staff understand what permits and approvals have been obtained, know your responsibilities, and have the supporting documentation and site activities to confirm the compliance level. The second thing you may wish to do is to create a plan for inspections and then train with it (seek help if you need it for creating this type of plan).

### Conclusion

By following these simple strategies, you can turn a potentially unpleasant experience into a beneficial one. Provided you're in compliance, have all necessary permits and approvals, and have a solid plan for conducting environmental inspections, the inspection will likely be brief and successful, and the inspector may not visit again for several years.

Here is a quiz on environmental inspections that can be used during your environmental training sessions or staff meetings. All are True/False statements with the answers provided.

### Questions:

1. You can always refuse to allow an environmental inspector on your property. **T F**
2. Environmental inspectors will inspect only what they intended to investigate and nothing else. **T F**
3. Having an environmental permit typically gives the regulatory agency the right to inspect your site. **T F**
4. Environmental inspectors should not be required to wear PPE during a site inspection if they refuse to do so. **T F**
5. It really doesn't matter who speaks to an environmental inspector during the inspection. **T F**
6. Someone from the plant should always accompany an environmental inspector and request a summary of the findings and any need for follow-up action at the end of the inspection. **T F**

7. You may have an environmental inspection if someone has filed a complaint against your plant for alleged activities harming the environment. **T F**
8. Being in compliance with all required environmental permits and approvals is your best strategy for managing environmental inspections. **T F**
9. Most precast concrete manufacturers don't have a need for environmental inspection planning. **T F**
10. Review the credentials of all inspectors and obtain a business card if possible to safeguard against unauthorized visitors to your plant. **T F**
11. If a designated plant spokesman is not available, most environmental inspectors will leave and return another day. **T F**
12. Training for environmental inspections is usually a waste of time in the precast industry. **T F**

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<sup>1</sup> National Pollutant Discharge Elimination System

### Answers:

1. **False.** In most cases, if you have an environmental permit of some type, you have essentially given permission to the regulatory agency to conduct an inspection of your site for compliance. If you have no permits, you may have the right to refuse entry, but do so under appropriate legal guidance.
2. **False.** Environmental inspectors may investigate other issues during their inspection that are not directly relevant to the initial reason for the visit.
3. **True.**
4. **False.** You should require all visitors to your site, including environmental inspectors, to take the same required safety precautions that are expected of plant employees.

5. **False.** All visitors, including environmental inspectors, should be directed to the designated spokesperson for your plant.
6. **True.** No visitors should tour your precast plant without accompaniment.
7. **True.** This may occur even if the allegations are false.
8. **True.**
9. **False.** All plants should plan for environmental inspections.
10. **True.**
11. **False.** Environmental inspections are going to occur whether or not you have a designated staff spokesperson.
12. **False.** Training for environmental inspections is invaluable and can be very constructive.



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**Even minor changes to original contracts and projects should be documented and retained – just in case.**

# Get It in Writing!

BY BRIDGET McCREA

**W**hen a customer requests a slight change to an original job contract, Sunny Semidei likes to get everything in writing, even if the documentation comprises a short email message. As manager at Puerto Rico Precast Concrete (an Atlantic Precast company) in Toa Baja, Puerto Rico, Semidei has heard the horror stories from contractors who were left holding the bag on projects that changed midstream without proper documentation and acknowledgement.

"I personally write everything down on the customer's file," says Semidei, "including date, time and exactly who ordered the change." Having that information on hand works in Puerto Rico Precast's favor when busy customers call a few weeks later claiming that the conversation never happened. "When you get it down in writing and then follow up with the customer immediately via email to confirm the conversation," says Semidei, "you have solid proof that the change order or other communication took place."

Semidei says that attention to detail begins when the order to "dig a hole this big" or "rotate a hole in this manner" comes in. She sends out an email to confirm the order and includes as much detail as possible. Change orders are handled in a similar fashion and usually involve the project's owner or site engineer (and not the client's accounts payable department, which ultimately has to cut the check to cover the additional work and/or changes).

Remember, she cautions, that the person who is on the job site expediting activities isn't the same person who is handling the accounts payable process. "Sales reps and contractors on site try to resolve problems – such as replacing a broken piece that wasn't due to precaster error – quickly in order keep the

job moving," says Semidei, "but without getting a commitment in writing from the contractor for payment. This usually is only beneficial for the contractor, not the precaster."

The problem doesn't end there. If the job is covered by a payment bond, says Semidei, then that bond should be amended to include the change order. "If not, claims for payment may not be accepted within the scope of the bond," she says. As an added measure, Semidei always tries to get acknowledgement of the emails and/or paper communication that the company sends out. "Ask them to sign the paper or use a digital signature application to ensure they read it and acknowledged it."

Taking that extra measure also helps when it comes to collections, says Semidei, who has used her written documentation to prove the existence of outstanding invoices and debts. A field engineer who asks for a change order and who doesn't document the request, for example, can cause issues for precasters who want to get paid for the completed job. "If you can pull up documentation and prove that the request and the work took place," says Semidei, "you'll be in a much better position to get paid promptly."

## Working without a net

In today's competitive and litigious business environment, there's no excuse for "working without a net" by not properly documenting change orders and having customers sign off on them before performing the additional work. Defined as the addition or deletion of work from an original contract, a change order alters the original contract amount, completion date and scope of the work to be performed. Some are minor in scope,

but others can significantly alter the construction process and project outcome.

Naturally, change orders are most prominent in larger projects that have many different moving parts and pieces. In some cases it can be nearly impossible to predict exactly how each of those pieces will be built – and how they will all work together – when the original plans are being laid. In many instances the work scope itself may have been improperly estimated, or perhaps the project team stumbled upon obstacles or other issues that have to be resolved “outside” of the original plans.

Budgetary issues also come into play and can force precasters to retrace their steps and come up with new alternatives that help customers meet their budgets. Regardless of the driving force behind the change order, in most cases the project owner or manager will call on the precaster to make the changes. Once that change order is submitted, it alters the original contract and becomes a part of it.

Due to the nature of the construction industry and its “let’s get it done yesterday” mentality, change orders are often issued under time-sensitive conditions. A site engineer could literally be standing on the job site in front of precast pieces that need to be altered on the spot as quickly as possible.

As Semidei points out, it’s too easy to get caught up in the “rush job” mentality of the typical job site and overlook the long-term consequences of not documenting change orders (namely the fact that you won’t get paid for the additional work performed).

“Always try to memorialize everything in writing,” advises Tyrus Cobb, general counsel for Jensen Precast in Sparks, Nev. The customer who needs five more manholes stacked out by Tuesday, for example, warrants at least an email or fax confirmation that recites exactly what was requested: “Per our discussion today via telephone, we will be providing five additional, stacked-out manholes on Tuesday, July 10, at a cost of \$\_\_\_\_\_.”

“That communicates to the customer your understanding of exactly what was ordered, at what cost, and for what delivery date,” says Cobb. “Once you hit Send on the document or email, it’s the customer’s responsibility to respond and let you know if the order is incorrect.”

The written confirmation process also helps when dealing with project bonds, which generally cover only the amount of the original order, unless otherwise specified and agreed upon in writing. “Bond companies only pay up to the amount of any documented agreement,” Cobb explains. “If you have signed

agreements for \$50,000, and if you wind up with \$20,000 in undocumented change orders, the bond company won’t cover the additional amount.”

But if the additional \$20,000 in work was properly documented in a three-line email message and – if possible – approved in writing by the client, the collections process will be infinitely easier. “A short email is just as admissible as any other type of written document,” says Cobb, who advises precasters to send out their emails or faxes before performing any work. “That shifts the burden to the customer to respond to you in some way, shape or form,” says Cobb, “and lets you know if they don’t want you to do exactly what is in that paper or digital document.”

### It’s your right

Written change orders aren’t just a luxury – they are a necessity for precasters who want to get paid fairly and in a timely fashion for unexpected additions to jobs of all sizes. Because most contracts (and subcontracts) allow owners, site engineers and other approved parties to make changes in the work to be performed, today’s precast concrete manufacturers

## Covering Your Assets: Tips for Change Order Success

- Make sure the owner’s representative who is working on site has the authority to execute change orders.
- If anything occurs during the course of the project that alters the scope, price and/or time of the project, prepare a change order and have the customer sign it.
- Always address the issue before starting on the work. Don’t ignore it until it’s too late to cover your assets.
- Shoot off an email or fax immediately after speaking to the site engineer or owner about the changes.
- Include in your correspondence the scope of the project, cost and delivery date.
- Remember whom you spoke with and make your own notes about the conversation for future reference.
- Be specific. Spell out in detail the additional work and – whenever possible – have the customer sign off on it.
- Include in your correspondence the necessary drawings, specifications, cost estimates, new deadlines and payment terms.
- If you’re subcontracting any work, you’ll want to reaffirm the hourly rate that those firms will charge for time and materials.
- Retain all written correspondence and handwritten notes to use in court, should they become necessary for collections.
- Dig deeper. Read “Construction Contractor’s Legal Toolbox” by Christopher L. Grant. This book is available from the Online Store at [precast.org](http://precast.org). To order, simply logon to the website, click the Members & Guests button, complete your login information and click the Online Store link. Questions may be directed to Sara Deuser at [sdeuser@precast.org](mailto:sdeuser@precast.org) or (800) 366-7731.

need a process for handling such revisions.

"Our industry traditionally has been pretty bad at documenting things, namely because projects are so fluid," says Cobb. For example, the precaster who gets a frantic call from a customer at 8 p.m. on Friday night, asking for five more manholes to be stacked out and ready to install by the following Tuesday, isn't necessarily inclined to write up a quote and the change order details and send them out for confirmation. "He'll say, 'Sure thing' and get moving on the new order," says Cobb.

Sometimes the very nature of the precast product lends itself to that lax approach, Cobb adds. "You assume that the customer won't stiff you because there are going to be five manholes in the ground, but it can happen," he says. "The best way to ward off those issues is by documenting the change ahead of time and having open lines of communication with your customer. That way there's less likelihood that there will be a disagreement over what was done and whether you should get paid for it or not."

John Greenhall, an attorney and shareholder at law firm Cohen Seglias Pallas Greenhall & Furman PC in Philadelphia, concurs. He says that disputes over construction claims and payouts often come down to "who plays the game better." Smaller projects tend to be particularly onerous since they likely involve small change directives that don't take much time to handle and don't cost thousands of dollars. But those small amounts can

add up to significant sales losses over time.

By getting everything in writing at the outset, Greenhall says precasters will come to the table in a much better position than the firm that works solely on verbal agreements and orders. "If you're fighting for your money and relying on oral conversations that took place during the course of the project, you'll lose, because no one on the other side will remember what was said," Greenhall warns. "A more effective approach is to get all contract provisions and change directives down on paper."

Sometimes it pays to take a defensive approach in business, says Greenhall, who has worked with numerous contractors in their quest to get paid for jobs completed. Expensive and time-consuming legal battles can surface when the precaster performs the work without solid proof that anyone asked for it.

"Look," says Greenhall, "at the end of the day you just don't have any friends in construction." Even a \$500 addition to a job should be documented via email or fax, he says, to ensure 100% payment by the owner, general contractor and/or bond company. "If you don't get it in writing," says Greenhall, "the chances that you'll never see that compensation are pretty high." ■

*Bridget McCrea is a freelance writer who covers manufacturing, industry and technology. She is a winner of the Florida Magazine Association's Gold Award for best trade-technical feature statewide.*



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FRONT ROW: RICK KIRCHNER, PRESIDENT; GREGORY POLLARD, VICE PRESIDENT; STEVE KIRCHNER, VICE PRESIDENT OF PRODUCTION

BACK ROW: BOB HUSAK, SALES; LAUREN SUSTIC, PRODUCTION ENGINEER; MIKE DEMEESTER, PLANT SUPERINTENDENT



# ADVANCE CONCRETE PRODUCTS

*A Custom Casting of People and Products*

BY SUE McCRAVEN | PHOTOS BY SUE McCRAVEN AND RON HYINK

**D**riving up the gravel entrance of Advance Concrete Products in Highland, Mich., the gray, overcast morning suddenly seems brighter. There's a feeling of optimism and hope in the air, and it's not just the spring flowers and well-kept landscaping. There's a "help wanted" sign out front, a rare and welcome sight in a state with a deflated construction industry and record-high unemployment. And this positive impression only grows upon meeting the company's staff.

Advance Concrete Products (ACP) has established a regional reputation for quality custom precast products with a broad customer base that includes state DOTs, universities, hospitals and utility companies. When asked about challenging precast projects, Rick Kirchner, president, smiles and says, "We like complicated. We like difficult. We like unique." When asked about product diversity, he explains, "It's our communication with the customers and their needs that has led to the reshaping and evolution of our products and equipment."

With ACP's 46 years in the construction industry, the result of this continuous dialogue with long-standing customers has created the company's reputation for producing challenging, quality custom precast concrete products.

## **"It's not about me"**

ACP's history, its success and its company culture are "all about the people here," Rick says. "It's not about me."

For example, right now ACP is looking to hire a new employee. "We don't hire a lot of people. We hire for the long term." The reason Rick can say this is because a potential ACP employee faces a discerning (and likely grueling) interview process. He recently reviewed 145 candidates for a night-shift welder. Average tenure of the company's long-time staff is remarkable and Rick's hiring decision "has to be good 20 years from now."

So if it is the employees who are the real story behind ACP, it made sense to interview each of the company's principals, asking them to talk about their best and worst jobs, their biggest concerns and what makes the company tick. Here are their stories.

## **Worst job: Mackinac Island sludge tank hits the waves**

"First, you have to understand that no vehicles are allowed on Michigan's Mackinac Island in Lake Huron," says Gregory A. Pollard, vice president, who has been with ACP for 34 years. "Only bicycles and horses are permitted for resident and tourist transportation. In the fall of 1991, ACP was delivering a crane and a 50-ft by 50-ft precast sludge storage tank (for horse manure) by



**“Our guys have been around here long enough to know when something is off, and they are great at ‘MacGyvering’<sup>1</sup> it fast.”**

— Steve Kirchner

barge to the island. Well, the crane got off OK onto the island’s dock ramp. But just when the loaded double-flatbed truck was driving off the barge, a large wave came in, pushing up the barge, causing the tractor’s front axle (which had already rolled off the barge) to crash down hard over the edge of the barge. Now we had 115,000 pounds of precast product sitting on the barge and the truck’s front axle suspended in thin air over the water. The waves kept rolling in and we thought we were going to lose the truck. Rick radioed the crane driver, who was already working at the installation site, to return to the dock immediately.”

Luckily, the crane operator was able to lift the truck chassis onto firm land and the driver was able to pull the load onto the island. Needless to say, the Mackinac Island tourists and business owners did not appreciate a 60-ft-long, trailer-mounted crane rumbling down their quaint, historical main street. To top that off, Greg laments: “Later that day, the contractor calls and says he’s missing a panel (it was there all along). That’s the kind of job where you just want to die. There are so many unknowns in this business.”

### **“What if?” and the importance of being prepared**

“The toughest part of my job is the stress of not knowing what could happen next – with the plant, with a truck, or a problem with a piece of equipment – anything,” says Rick’s brother Steve Kirchner, vice president of facilities. While Rick handles administration indoors, Steve is the outside, hands-on man, always in the production plant.

“We’re pushing ourselves big time right now,” explains Steve. “The guys are under the gun and if something goes wrong, we need to fix it fast.” For example, the day before NPCA’s visit, the aggregate weights on the electronic scoreboard didn’t look right – they were going down. “Around here, we notice right away when something is wrong,” he says. “The jaws on the scale hopper broke. Our guys have been around here long enough to know when something is off, and they are great at ‘MacGyvering’<sup>1</sup> it fast.

Steve, an engineer who is ACI-certified in testing, has spent most of his time since high school working in the plant with his father, Ron Kirchner. He remembers his dad always posing the question to him and his brothers: “What if?” Kirchner senior was always prepared (see the sidebar “A Better Way to Treat People”) and is the reason ACP has a large capital investment in redundant equipment on site, including cranes, trucks and a back-up mixer.

### **22 years: average tenure**

When it comes to the average tenure among employees at ACP, Steve is not exaggerating. The average length of employment for ACP staff members is 22 years, a remarkable achievement considering the economic downturn of the last several years. Michigan was one of the states hit hardest by the Great Recession, with huge losses in manufacturing and high numbers of unemployed.

But even through the recent lean years, when



STEVE AND RICK KIRCHNER PROUDLY DISPLAY THE “WHAT IF?” SIGN IN VARIOUS PLACES AROUND THE PLANT AS A REMINDER OF THEIR FATHER’S MANTRA OF BEING PREPARED FOR THE UNEXPECTED.



## A Better Way to Treat People

When asked about Ron Kirchner, the founder of Advance Concrete Products, there's one consistent response. "My dad put the employee before anything else in the company," said Steve Kirchner. During one hard stretch, Ron took out a note on his car to pay employees. This business philosophy took root when Ron was young and worked as a superintendent of about 200 employees in two precast plants. "Dad saw how other companies would hire people when they were busy and then lay them off during slow times," explains Rick Kirchner, "and it didn't set well with him. He felt that's not the way to treat people."

"Dad liked to work," says Steve, "and he was always an entrepreneur who wanted to start his own company." In 1966, Ron began ACP on 10 acres in Highland, Mich., with his partner, Tom Engle. Starting from scratch and a lot of sweat equity – with only himself, Engle and another man – Ron began producing precast concrete septic tanks. Even after Ron built up a successful business, "he drove a beat-up, four-cylinder Pinto with a stick," remembers Steve, laughing. "He wasn't concerned with outward appearances."

"But Ron made sure his salesman had a new Oldsmobile Toronado," recalls Gregory Pollard. "He was always ahead of the curve."

work was down, ACP had no layoffs. This is perhaps a more remarkable statement about the ethics and policies of ACP management than the length of time workers stay with the company. "We are always digging for jobs and making sure the guys are working," says Bob Husak, sales. "We were under a lot of pressure the last three years, where we had only 20 hours of production work (per worker per week), but we made sure staff (paychecks) got closer to 40 hours."

### Specializing in custom work

Starting out in the mid '60s, company founder Ron Kirchner, partner Tom Engle and another man produced only septic tanks. By the mid '70s, "We had only three sizes of manholes and eight or so forms," says Steve. "Now, we rarely have a run of manholes that are the same."

Today, ACP does mostly custom precast concrete work based on complex specifications. It produces a wide range of precast products, from commercial utility vaults, manholes, handholes and storage tanks to box culverts, Storm Safe shelters, and Adspan three-sided bridges and tunnels.

When queried about the wide range of products, Rick replies, "Our customers

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—Mike Demeester

define our product. Challenging custom work is now our forte. We over-engineer. We use high-early cement. We take on complicated, difficult jobs and our whole team, from sales to production, will look at it. We look at the customer’s needs, time and weight constraints, crane limitations. It’s not a cookie-cutter approach. Even if it costs overtime and inventory, we’ve never missed a delivery date. We’re not going to be



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caught off guard. We’re not going to cut corners. But that’s our reputation.”

### **Best part of ACP**

Mike Demeester, plant superintendent, is a no-nonsense professional who has been with ACP for 36 years. At work every morning by 6:30, Mike’s toughest job, “at my age, is the hours and keeping the guys motivated. We were slow for a couple of years, now it’s 50 to 55 (hours per week).”

With his long history at ACP, Mike is perhaps the best person to ask about the real heart of the company and why people stay. “I enjoy the work and love working outside,” says Mike. “I like the owners, they’re real fair here. We’re like one big family, we hang out together, do stuff together. We haven’t let anybody go since ‘82. For the last two years, we could probably have used three guys out there and get by, but they kept everyone around in tough times.”

Mike revealed one of the big reasons for the company’s success: “We’re flexible. A lot of customers will call on Thursday and want a manhole delivered on Saturday. Guys come in at night, come in early to get the product to the customer. I’m proudest of our work ethic. We produce a good product here.”

### **Anyone can sell at a low price**

“My toughest job is trying to convince potential customers that ACP precast is a better product and why,” says Bob Husak, sales. “Anybody can sell at a low price. It’s easy. My job is to sell our product and the company, to convince purchasers of the quality that’s behind it and the service they will get throughout the whole project, from start to finish.”

Like all the principals at ACP, Bob is multitasking and well connected with a broad range of customers, from schools and universities to hospitals and utilities. Bob brought in a large and difficult (“never-ending spec changes, never alluded to in the bid”) two-year Marathon oil refinery job in Detroit that helped carry the company through the recent lean years. He estimates jobs and is able to make minor adjustments to 1-D CAD drawings for hurry-up, last-minute change orders.

Bob is fairly famous at ACP for bringing in unprecedented, complex designs and asking production: “Hey, you guys think you can make this?” He follows jobs closely from the winning bid through on-site installation to calling the customers afterward to make sure they’re completely satisfied. And Bob’s preferred job? “A problem, an issue that I need to get solved.”

### **Value of NPCA certification and a flexible staff**

A mechanical engineer, NPCA and ACI liaison and niece of Ron Kirchner, Lauren Sustic has been with ACP 26 years and handles all DOT projects as well as her largest (and favorite) project: replacing underground steam lines and electrical and communications vaults for the construction of the new FRIB<sup>2</sup> at her alma mater, Michigan State University.

Though she is very busy with these projects, Lauren takes time to explain why ACP has a good reputation for quality precast products. “We believe everyone should be involved in quality,” says Lauren. “What NPCA certification does is increase



our quality control, because everyone knows that an inspector can come in at any time.” ACP had two inspections in 2011. The company has been continually certified by NPCA since 1991 and was the first Michigan precast plant to receive the industry’s 20-year certification recognition.

Before she goes back to calling on customers to check on installations, Lauren explains why ACP is successful and a great place to work. “We have a versatile staff that is able to work in a variety of disciplines, from estimating and bidding jobs to CAD design and sales.”

While more comfortable in the field with hardhat and boots, when times were slow, Lauren “put on ‘the suit’ and went out talking with industry engineers and architects to hunt down work.” When pressed to say what is best about ACP,

Lauren responds without hesitation: “Everybody in this company treats one another like family, and we treat our customers the same way.”

### If money were no object?

You can feel the positive energy and optimism at ACP, from the hiring sign out front to the urgent pace of the production staff. But it’s tough to get an answer out of Rick when asking him what’s on the company’s forecast and where they hope to diversify and expand in the precast market. Rick is clearly a man who keeps things close to the vest and has his father’s strong will when it comes to hard work, a quality product and protecting the company’s excellent reputation.

Rick won’t say where he’s steering the company, but there’s definitely a sense of something big pending around the plant. “We don’t really know if this (increase in business) is a blip or a trend,” he says. “But we are going to make sure we are prepared for new state and industry investment in building and repairing Michigan’s deteriorated infrastructure.” ACP has a strong working relationship and reputation with MDOT, ODOT and INDOT.

### The play’s the thing

These frank dialogues from the company’s star players open the curtains on ACP’s secret to success. Not unlike an award-winning Broadway play, ACP delivers a quality performance. Beginning with Ron Kirchner’s careful direction during the company’s opening “scenes” and continuing with the delivery of its flexible, multitalented “actors,” ACP’s story is based on the custom casting of both people and precast concrete products.

While giving nothing away, Rick sums up the company goals: “We don’t want to be the biggest. We want to be an exceptional precast producer, ethical and trustworthy.” As the curtains close on this Precast Inc. viewing, this company really is its people, and as the economy brightens, ACP intends to be ready. ■

*Sue McCraven, NPCA technical consultant and Precast Solutions editor, is a civil and environmental engineer.*

<sup>1</sup>“MacGyver” is a resourceful troubleshooter, named for a television series character famous for solving complex problems with everyday materials at hand.

<sup>2</sup>FRIB stands for Facility for Rare Isotope Beams; MSU outcompeted MIT and other premier universities to be named by the U.S. Department of Energy Office of Science as the site for the \$550 million project. The FRIB is expected to create \$1 billion in economic activity and 400 new jobs for Michigan.

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# Precast Math Tools: Calculate Manhole Blockout Volumes

How to precisely calculate large block-out volumes with a triple integral or handy chart.

BY ERIC BARGER

A common calculation in precast concrete manufacturing is determining the volume of a round blockout in a manhole wall. A round blockout is a hole either cast or cored into the side of a manhole wall. Mathematically, there are several methods to calculate this volume, ranging from a simple geometric formula to the theory-intensive calculus method.

The complex shape made by the blockout requires the use of upper-level mathematics and/or 3D CAD, which are two of only a few means for precisely calculating the volume of the blockout. Even armed with the calculus formula or 3D CAD, a specialized computer program or calculator that can solve integrals will be needed to calculate the final value. The key word in this approach is calculating “precisely.”

A 5% error between the cylinder method and calculus method manifests itself once the diameter of the blockout reaches 65% of the inside diameter of the manhole. The error then continues to grow to more than 9% when the diameter of the blockout reaches 85% of the inside diameter of the

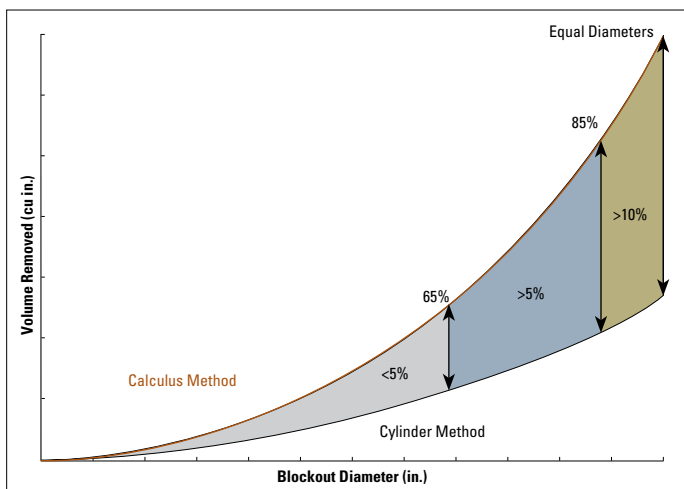


FIGURE 1.

manhole (see Figure 1). This difference in volume between the two methods is small when looking at the difference in weights. The cylinder method is still close enough to continue to use for blockout weight approximations (see Figure 2).

## When to use the cylinder or calculus method

The formula for a cylinder ( $\pi r^2 h$ ), where  $r$  is the radius of the blockout hole and  $h$  is the wall thickness, can be used to approximate the volume of a blockout. This will be referred to as the “cylinder method” and is close enough if you need a quick and easy calculation.

The “calculus method” uses a triple integral to determine a precise volume. The calculus method must use specific software or certain scientific calculators for a numerical answer. Using these tools, an equation can be derived specific to each manhole for different sizes of blockouts. Using these formulas, it is possible to get more precise answers than with the cylinder method.

When coring or using a blockout to form a 12-in.-diameter hole in a 48-in. inside diameter (I.D.) manhole, it makes little difference whether the cylinder method or the calculus method is used to solve for the volume. However, change the blockout size to a 36-in.-diameter hole in the same 48-in.-I.D. manhole, and the difference in volume between the two methods starts to differ significantly as shown in the following examples.

**Example 1.** Calculate the volume for a 12-in.-diameter hole to be cast or cored in a 48-in.-I.D. manhole with a 5-in. wall thickness.

### Cylinder formula

$$\text{Volume} = \pi r^2 h = (3.1416)(6 \text{ in.})^2(5 \text{ in.}) = 565.49 \text{ in.}^3$$

**Calculus method**

$$\frac{1}{4} \text{Volume}_{\text{Wall}} = \int_{\text{I.D.}}^{\text{O.D.}} \int_0^{\text{Core radius}} \int_0^{\sqrt{\text{Core}^2_{\text{radius}} - x^2}} \frac{r}{\sqrt{r^2 - x^2}} dy dx dr$$

**Calculus solution**

Volume = 569.2 in.<sup>3</sup>

**Example 2.** Calculate the volume for a 36-in.-diameter hole to be cast or cored in a 48-in.-I.D. manhole.

**Cylinder formula**

Volume =  $\pi r^2 h = (3.1416)(18 \text{ in.})^2(5 \text{ in.}) = 5,089.4 \text{ in.}^3$


**Calculus solution**

Volume = 5,456.64 in.<sup>3</sup>

Then there are the tapered blackout holes – and a calculus formula for that as well. However, there is also a simpler method. If a blackout tapers from 26 in. to 24 in. in diameter, solve for the average of the two (25-in. diameter) in this case. Using the average diameter will produce an accurate approximated volume.

**Conclusion**

Comparing the results of the two examples, one can note the volume difference between the cylinder method and calculus method. The cylinder method is and will continue to be the fast and easy method to getting a quick volume that is close enough. Having said that, the actual difference in weight between the two formulas could be as much as 1,000 lbs when considering an 8-ft round manhole with two large-diameter blockouts. Admittedly, there is not a significant weight difference between the two formulas throughout the normal range of blackout sizes on most manhole sizes produced. For those who desire to calculate precisely how much concrete is removed due to a blackout, the difference may seem more significant.

The derived equations for each round product line are listed below. These equations deliver answers that are very close in volume but not exact. The equations should yield answers that are accurate to within 1% of the actual volume. In addition, if you just want to use a quick reference and not worry about a calculation, one with precise volume calculations using the calculus method is shown in the accompanying chart. 

*Eric Barger is vice president of C.R. Barger & Sons Inc., Lenoir City, Tenn.*

**References**

Howard, Rebecca. *Wall Volume from Hollow Cylinder - No Taper*. 2010, from [www.PrecastWorld.com](http://www.PrecastWorld.com).

**Derived volume equations:**

- 48"Ø y = 0.0394x<sup>3</sup> + 2.2728x<sup>2</sup> + 20.337x - 46.043
- 60"Ø y = 0.0381x<sup>3</sup> + 2.71x<sup>2</sup> + 31.02x - 91.24
- 72"Ø y = 0.0331x<sup>3</sup> + 3.516x<sup>2</sup> + 35.409x - 122.6
- 84"Ø y = 0.0331x<sup>3</sup> + 3.9561x<sup>2</sup> + 49.01x - 202.86
- 96"Ø y = 0.036x<sup>3</sup> + 4.0295x<sup>2</sup> + 76.234x - 379.22
- 120"Ø y = 0.0329x<sup>3</sup> + 5.2785x<sup>2</sup> + 102.99x - 635.59
- 144"Ø y = 0.0294x<sup>3</sup> + 5.8833x<sup>2</sup> + 128.6x - 949.62

**Assumed wall thickness:**

- 48"Ø - 5"
- 60"Ø - 6"
- 72"Ø - 7"
- 84"Ø - 8"
- 96"Ø - 9"
- 120"Ø - 11"
- 144"Ø - 12"

**HOLE VOLUME FOR ROUND STRUCTURES**

		Manhole I.D. (in.)						
		48"	60"	72"	84"	96"	120"	144"
4		62.9	75.4	88.0	100.6	113.1	138.2	150.8
6		141.6	169.8	198.1	226.3	254.6	311.1	339.4
8		252.1	302.2	352.3	402.5	452.7	553.2	603.4
10		394.5	472.6	550.9	629.3	707.7	864.6	943.0
12		569.2	681.4	794.0	906.7	1019.6	1245.4	1358.2
14		776.6	929.0	1081.9	1235.1	1388.6	1695.8	1849.1
16		1017.3	1215.5	1414.8	1614.7	1814.9	2215.8	2416.0
18		1291.7	1541.6	1793.2	2045.7	2298.8	2805.9	3058.8
20		1600.7	1907.6	2217.3	2528.5	2840.5	3466.0	3777.8
22		1945.0	2314.2	2687.7	3063.5	3440.4	4196.5	4573.1
24		2325.6	2762.0	3204.9	3651.0	4098.8	4997.6	5445.0
26		2743.8	3251.9	3769.5	4291.5	4816.2	5869.6	6393.6
28		3200.8	3784.7	4382.0	4985.6	5592.8	6812.9	7419.3
30		3698.5	4361.4	5043.3	5733.9	6429.3	7827.8	8522.3
32		4238.6	4983.2	5754.1	6536.9	7326.1	8914.8	9702.9
34		4823.7	5651.4	6515.4	7395.4	8283.8	10074.1	10961.3
36		5456.7	6367.5	7328.2	8310.1	9303.0	11306.3	12298.0
38		6141.3	7133.2	8193.7	9281.9	10384.4	12611.8	13713.3
40		6882.4	7950.7	9113.0	10311.7	11528.8	13991.3	15207.5
42		7686.6	8822.2	10087.7	11400.6	12737.0	15445.3	16781.2
44		8563.4	9750.5	11119.3	12549.7	14009.8	16974.2	18434.7
46		9528.0	10739.2	12209.7	13760.2	15348.2	18579.0	20168.4
48		10613.4	11792.2	13360.9	15033.5	16753.2	20260.1	21983.0
50			12914.8	14575.3	16371.1	18225.9	22018.4	23878.9
52			14113.5	15855.6	17774.8	19767.6	23854.7	25856.7
54			15397.2	17205.0	19246.3	21379.6	25769.8	27916.9
56			16778.4	18627.2	20787.8	23063.3	27764.6	30060.2
58			18277.1	20126.6	22401.6	24820.4	29840.1	32287.3
60			19935.3	21708.5	24090.3	26652.5	31997.3	34598.9
62				23379.7	25857.1	28561.6	34237.4	36995.7
64				25148.4	27705.3	30549.9	36561.5	39478.4
66				27026.1	29638.9	32619.6	38970.9	42048.0
68				29028.2	31662.6	34773.4	41467.0	44705.3
70				31179.7	33781.9	37014.0	44051.3	47451.2
72				33531.9	36003.5	39345.0	46725.2	50286.7
74					38335.4	41769.8	49490.6	53212.8
76					40788.2	44292.7	52349.3	56230.7
78					43375.3	46918.7	55303.2	59341.4
80					46115.8	49653.3	58354.4	62546.3
82					49039.3	52503.2	61505.3	65846.6
84					52206.5	55476.4	64758.5	69243.8
86						58582.6	68116.6	72739.3
88						61834.2	71582.8	76334.6
90						65247.2	75160.3	80031.5
92						68844.1	78852.8	83831.7
94						72659.1	82664.6	87737.2
96						76762.6	86600.1	91749.9
98							90664.4	95872.1
100							94863.4	100106.1
102							99203.8	104454.5
104							103693.4	108919.9
106							108341.1	113505.3
108							113157.6	118214.1
110							118156.4	123049.4
112							123353.4	128015.5
114							128770.0	133116.3
116							134435.3	138356.3
118							140393.4	143741.0
120							146734.2	149275.8
122								154967.2
124								160822.6
126								166850.0
128								173058.9
130								179460.5
132								186068.5
134								192898.2
136								199970.0
138								207309.5
140								214952.1
142								222951.0
144								231413.9

# The Cost of Quality: Increasing Profits in the Precast Industry

**A quality management system can actually help you reduce production costs.**

BY SAM LINES

**C**an you afford to adopt a documented quality management system? The better question to ask is this: Can you afford not to have a quality management system? This question is often the center of debate among many small- and medium-sized precast concrete producers. The larger plants can afford the resources necessary to develop the documentation, procedures, forms and tests that are required as part of a formal quality system.

One of the popular quality systems for the precast concrete industry is the National Precast Concrete Association (NPCA) Plant Certification Program. This program has a foundation of industry-specific standards that have been established as the necessary requirements for a precast plant to implement in order to produce the best quality concrete products. Each plant develops its own procedures and work instructions that meet or exceed the NPCA requirements. Plants are audited annually through unannounced inspections by an independent auditing firm. The precast plant must meet a minimum score to maintain its certification.

Maintaining a quality system requires a disciplined effort from the precast producer. Depending on the size of the operation, daily inspections and concrete testing are required. In some cases, multiple tests are required each day. The additional

indirect labor required for quality is one of the major obstacles for plants when deciding whether to become certified. It is often viewed as an additional cost to the operation that will shrink profitability. However, when they look at the costs of making faulty products, they may find the opposite to be true.

## **Quality cost categories**

Quality costs can be divided into three distinct categories: prevention costs, appraisal costs and failure costs. The failure costs are further divided into internal and external. In a perfect world, there would be no failure costs. But we don't live in a perfect world; we live in the real world.

Experts agree that a typical manufacturing organization's total quality costs range from 20% to 30% of sales. This is the sum of all of these categories. Implementation of a documented quality system will have a tremendous impact on reducing these costs, primarily in the failure category.

Explained further, prevention costs are all of the activities performed to prevent poor quality. The cost to develop documented procedures, forms and work instructions are in this category. Also, the salary of a quality manager may be in this category. This is often referred to as quality assurance.

Appraisal costs include inspection and testing activities.

Activities prior to manufacturing, such as design and purchasing, also have inspection activities. This is often referred to as quality control.

Prevention and appraisal activities are in place to reduce or eliminate failure costs. A lack of either of these activities will not prevent defective product from being produced and shipped. Every manufacturer should have some form of prevention, appraisal or both.

Failure costs are not desirable. If you did not make the product right the first time, then making it right the second time adds cost without adding value. Manufacturers with high failure costs will struggle to stay in business. To offset the high cost of repair and rework, wages for direct labor will be lower than comparable companies. These companies will typically hire unskilled labor, and may actually need to employ more laborers due to the extra time invested in repair and rework. In addition, not all products can be repaired – some are set aside and sold as seconds, or they are scrapped altogether. As the product gets further along in the manufacturing cycle, the cost for detection and repair is multiplied.

Here is an example: A mistake in the drawing that could be easily fixed for \$1 of labor in design can cost \$10 to repair if not caught until the pre-pour inspection. Further, a mistake that would cost \$25 to repair prior to shipment can easily cost 10 to 100 times more if the defect is found at the job site.

It is easy to see how the cost of quality can be 20% of sales. Also, quality costs are often like an iceberg: The hidden cost is many times more than the visible costs. Prevention and appraisal costs can be planned and budgeted into product costing, whereas failure costs usually cannot. In addition, prevention and appraisal costs will vary with the size of an organization, and are a blend of fixed and variable costs. Based on my experience as a quality manager in a large precast plant, where the quality department was staffed with five full-time employees, the appraisal and prevention costs range from 1.5% to 2% of sales. If the cost of poor quality is equivalent to 20% of sales, and the investment to prevent this is 2% of sales, then the return on investment is 900%.

In his popular book on the field of quality management “Quality is Free,” Philip Crosby lays out the case by explaining that a quality system is not an added expense, but rather a tool that is used to slash undesirable costs. Crosby states that “Quality is free, it is not a gift but it is free. What costs money are the unquality things – all the actions that involve not doing it right the first time.” A quality management system can help you achieve greater efficiency.

This is a shift in thinking for some people, but it’s as simple as the rule my dad always taught me: “measure twice, cut once.”

■

*Sam Lines, MBA, is sales/safety engineer and lean coordinator with Concrete Sealants Inc., Tipp City, Ohio. Contact him at (937) 845-8776 or visit [www.conseal.com](http://www.conseal.com).*

<sup>1</sup> Crosby, Philip. (1980). Quality is Free. New York:Penguin Group.



## REACHING NEW HEIGHTS

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# Workers' Injury Cost Containment and Management Process



**A Return-to-Work process should become part of your business solutions for both the worker and enhanced profit margins**

BY MICHAEL LADD

**M**any companies today are re-examining their efforts to control workers' compensation (WC) disability costs. In our current business environment, the return-to-work (RTW) process is no longer simply nice to have, it has become an owner or boardroom issue.

The primary purpose of the RTW program is to return eligible employees to the workforce as safely as possible at the earliest, medically allowable date. A big opportunity for cost savings may come in the avoidance of litigation. The company's resources for managing the RTW process determine the overall effectiveness of its program. When implemented, these simple steps could result in fewer lost days, decreased wage loss for employees and greater employee morale. That is a good outcome for everyone.

So where do you start? The best

practical solution is to expand your safety program by adopting a formalized RTW program. Write a policy statement and identify a return-to-work coordinator. The policy statement should outline your company's commitment to the RTW process and to help injured employees get back to work. Include the expectation that all employees will participate.

### Emerging issues

Every business in the United States faces three important emerging issues. The first is health care costs, which continue to rise faster than inflation. Those costs are reflected in the medical care costs. Employers are feeling increased pressure to contain the workers' direct compensation costs.

The second emerging issue is the average age of the U.S. workforce. The majority of the baby-boomer generation is now in their late 50s to mid 60s, but the economic recession, rising medical costs and low retirement savings have influenced workers to delay retirement. According to the U.S. Bureau of Labor Statistics, the total labor force was projected to increase 8.5% between 2006 and 2016. The most dramatic growth is projected for the two oldest groups: workers aged 65-74 and those aged 75 and older, both of which are predicted to soar by more than 80%. Older workers typically require more total loss days to recover from an injury, so WC expenses are expected to be higher.

The third emerging issue is the rising obesity rate of working adults and teenagers who are entering the workforce. The percentage of adults from 20 to 74 years old and clinically classified as obese has more than doubled. A study published in 2010 by the National Council on Compensation Insurance Inc. noted that there is nearly twice the injury frequency for obese workers. In addition, the medical costs for the same injury are three times higher among obese claimants in the first year, rising to five times higher at 60 months.

### 12 steps for an effective program

The RTW process has multiple steps. Naturally, implementing all of the steps will provide your company the opportunity for the most potential cost savings through improved productivity and increased employee morale. Start with a few steps at first. As your program evolves, add more steps until your company has its own fully customized program in place.

**Step 1.** Explain to the workforce that the company's WC insurance will pay for their medical bills related to on-the-job injuries and compensate them for their lost salary based on your state's WC commission regulations. List the WC benefits employees can expect to receive, and detail how much pay the worker would be entitled to and the maximum allowable payment under the law.

Also, outline a basic action plan to prepare employees to respond correctly to work-related injuries. Employees who are injured should understand the procedures and be given a handout that explains their coverage in whatever languages they speak.

Typically, the employee is paid two-thirds the average weekly

wage. The amount is not taxed, but it will be less take-home pay and therefore may present a potential economic impact on the worker and family.

**Step 2.** Pass out insurance cards that list your company's name, address, phone number, insurance company's name, policy number and WC policy expiration date. The card helps the clinic or hospital start the process correctly. Even better would be to have a RTW kit that provides the insurance card along with names and phone numbers of people you want the medical caregiver to contact for information. Also, include a job description and a job function evaluation (JFE) form in the kit. The job description and JFE give the medical provider a better understanding of the job's physical expectations. Step 11 provides more specific details.

## The primary purpose of the RTW program is to return eligible employees back to the workforce as safely as possible at the earliest, medically allowable date.

**Step 3.** Workers need to report injuries to their supervisor or crew leader. If the potential injury is not a broken bone, deep cut or something worse, many workers will want to wait and see if the pain goes away. That is not what you want them to do! Remind workers to report injuries even if they do not go to a clinic or hospital. Contact the worker the next day to find out if the pain from their injury persists or if he or she has a limited range of motion. If the pain has not diminished, advise them to seek medical attention. The company then needs to notify its insurance carrier of the injury.

**Step 4.** Provide the injured employee with immediate assistance to stabilize and address any bleeding until the emergency service arrives. Basic first aid supplies are necessary for compliance with state and federal employee safety laws and regulations. Local Red Cross chapters provide first aid training.

**Step 5.** Pre-select a physician or a clinic where your company would send an injured worker for treatment. This is an important step; however, you should be mindful of specific state laws that may restrict the employer's ability to participate in the selection of medical providers for injured workers.

When selecting a medical care provider, consider the clinic's hours, security, location, credentials, customer service and quality of care. Take every opportunity to communicate with your selected medical provider and build a working relationship.

**Step 6.** For minor injuries, appoint someone to transport the injured worker to the medical provider and take along the prepared RTW kit for the medical provider to review. Naturally,

an ambulance will transport a seriously injured person to the closest hospital emergency room (ER).

**Step 7.** Having the foreman or supervisor on board with the RTW process ensures the injured employee gets the help he or she needs. Having the key people understand and support the RTW program may prevent an unnecessary ER visit, ensures the injured worker will not be mistakenly billed for the medical treatment, and provides another source of information for the physician. The foreman or supervisor should speak to the physician after the exam to determine how to modify the injured person's original job or work tasks so the employee can return to work and not aggravate the injury while recuperating.

**Step 8.** If the injured worker requires extensive medical care involving prolonged time away from work, contact him or her within 24 hours of the accident to determine his or her condition, family needs and treatment progress. It is critical to make contact with a spouse or other family member, as family is important in making the employee feel wanted and needed back at work. Follow up with the injured worker at least every other week and assure him or her of your company's commitment to his or her well-being. While expressing concern, remember to honor the privacy protections afforded personal medical information.

**Step 9.** Report the accident to your insurance carrier promptly so cost containment efforts can begin. Reporting a WC injury to the insurance carrier within 24 hours can lower the accident's total direct costs by 5 to 6%. A delay in reporting can increase the cost of the injury.

Establish a RTW record that includes a copy of the accident report, a job description, copies of medical bills, progress reports from the physician, and a log of your conversations with the physician and your employee. This will assist you in tracking the current claim and establishing a model for handling future claims. Maintain control of the process to help the employee return to work as soon as practical.

**Step 10.** Complete an accident investigation and secure any evidence as soon as possible to understand the circumstances that led to the accident or injury. The primary focus is to prevent future occurrences. Contact the insurance carrier's claim department for further guidance in handling the evidence.

**Step 11.** Present the medical provider with a job description and a JFE document when the injured employee goes to the doctor for the first time. The JFE provides the treating physician with an objective description and quantification of the injured worker's job tasks. The evaluation should be completed for all jobs within your company to help the treating physician and related health care professionals determine the suitability of alternative job tasks, which may allow the injured person to return to work sooner with a temporary medical restriction. Explain the basic work activities needed to perform the job functions and estimate the frequency for each posture during a work shift.

Indicate whether the work is performed indoors or outdoors, and whether the job is performed in extreme temperatures. List or describe any personal protective equipment required, such as face shield, safety shoes, hard hats, etc.

**Step 12.** Having an effective transitional work assignment might result in a 10 to 25% reduction of WC indemnity costs. Identifying opportunities for transitional work at your plant, considering modifying existing jobs and involving employees in the development and implementation of the transitional work encourages a feeling of ownership and maximizes the opportunities for success.

It is common to limit the timeframe for a modified job to just 30 days. After that time period, it may be appropriate to establish another transitional work agreement with expanded physical capabilities and lesser medical restriction. Each revised work agreement sets new goals while the worker regains strength, flexibility and endurance. Do not forget to notify the insurance claim department so the adjuster can coordinate any change in benefits.

## Conclusion

Implementing an early RTW process has the potential to control the work-related injury costs and reduce the frequency of injuries by being aware of a worker's tasks. It provides workers the ability to return to work in some capacity when they cannot immediately return to their original positions due to injury or illness.

Paying injured workers their pre-accident rates of pay while on modified work keeps costs down while allowing them to focus on their recovery until they return to their original jobs. WC costs grow as income replacement benefits continue to be paid during the injured worker's absence.

An effective RTW process could result in an estimated savings of much as 10 to 40% of WC medical costs and 10 to 25% of wage replacement. Having an effective RTW process in place makes good business sense.

To see how much money your company could save by reporting injuries sooner and returning injured employees to work sooner, please visit [www.CNA.com/returntowork](http://www.CNA.com/returntowork). There you will find two cost savings calculators. You can also download various forms, questionnaires and checklists to help start a RTW program or strengthen an existing one. ■

*Michael Ladd is the consulting director of industrial hygiene services for CNA Insurance's Risk Control Department. He is a certified safety professional, a certified industrial hygienist and an Underwriters Laboratory-recognized risk engineer. He has more than 30 years of experience providing various consulting health-hazard services to a wide range of manufacturing, construction and service industry clients.*

*This material is for illustrative purposes and should not be construed as legal or other professional advice. All products and services may not be available in all states and may be subject to change without notice. CNA recommends professional counseling for these situations.*



# green PIECE

## Resiliency

BY CLAUDE GOGUEN, P.E., LEED AP | GRAPHICS COURTESY COMMUNITY & REGIONAL RESILIENCE INITIATIVE (CARRI) ([www.resilientus.org](http://www.resilientus.org))

**W**e've been hearing a lot about sustainable construction over the past few years. Now "resiliency" is the new buzzword. Sustainability and resiliency are actually complementary concepts, where resiliency relates to a more short-term recovery from a recent crisis while sustainability describes a long-term balance between consumption and resources. Resilient construction and development may seem like a new trend, but the concept has been around for many years.

What exactly is resiliency? According to the Department of Homeland Security (DHS), resiliency is the ability of any system (infrastructure, government, business and citizenry) to resist, absorb and recover from or successfully adapt to an adversity.

An "adverse occurrence" can refer to a range of various natural and man-made calamities including:

- Extreme weather (tornadoes, hurricanes or flooding)
- Geological (earthquakes, tsunamis and volcanic eruptions)
- Man-made crises (terrorism, war, forest fires, pandemics or large-scale industrial accidents)
- Economic (company closing, recession or depression)

### Identifying the risk

Nearly every part of the U.S. has been affected by severe weather conditions. In fact, for most of the country, there are a number of natural hazards to be concerned with from hurricanes to earthquakes (see Figure 1).

The Institute for Business and Home highlights how natural disasters affect Americans:

- In 2006, 34.9 million people were seriously threatened by Atlantic hurricanes, compared with 10.2 million in 1950.

- Approximately 40% of the population resides in counties that face medium-to-high seismic risk.
- One-quarter of residents live in a county that has been ravaged by wildfire during the past 25 years.
- In 2008 alone, there were 16 major tropical storms (eight of which were hurricanes), 1,700 tornadoes, and widespread flooding (due to winter and tropical storms, spring melts, and other severe weather).

In fact, according to the National Resource Defense Council, 3,251 monthly weather records were broken in 2011 by extreme events that struck U.S. communities. Both the frequency and intensity of some extreme events are likely to worsen with continued climate change.



FIGURE 1. HURRICANES, TORNADOES, FLOODING AND EARTHQUAKES AFFECT NEARLY EVERY REGION OF THE UNITED STATES.

## How resilient communities differ from the status quo

The Resilience Loss Recovery Curve (see Figure 2) helps explain how community function is affected by an acute disturbance (earthquake, chemical spill or hurricane) and depicts response and recovery curves. Community functions decline precipitously (blue and pink areas) as citizens respond to a disaster.

A more resilient community can more quickly restart vital local services (utilities, businesses, schools) and chart a path to a “new normal.” The more resilient community incurs some losses (blue area) but avoids additional losses (pink area), because it has taken informed measures (anticipating threats, disaster response plans and recovery strategies) to minimize the impact of the disturbance. Mitigation efforts of resilient communities include: improved land-use decisions and building code implementation; construction of resilient infrastructure; improved business and household planning to minimize loss; and a better orchestrated response of citizens and local agencies.

Resilient communities may find opportunities to transform themselves and grow. Thus, a resilient community’s “new normal” may be a higher level of function (Line A) or it may be able to return to a level of function existing before the disturbance (Line B). The key to disaster recovery is not only to get essential services back up and running, but also to get people back to work. That means buildings not only must resist the damages caused by an adverse event, but must be in a condition suitable to occupancy as soon as possible.

## Attributes of resilience

Key attributes of enhanced resilience are:

- Increased longevity
- Increased robustness
- Improved sustainability
- Improved life safety
- Increased durability
- Increased adaptability for reuse
- Increased resistance to disasters

Precast concrete has an excellent track record in all these categories. It does not rot or burn. It resists damage from flooding. It is extremely durable under the most extreme conditions, and has a service life that far exceeds most other building materials.

One of the ways to achieve enhanced resiliency is with a few modifications to existing model building code requirements. For example, current international building codes set the base flood elevation as determined by FEMA or local jurisdiction. The requirement for enhanced resiliency would set the minimum elevation at no less than 3 ft above the base flood elevation as determined by FEMA Flood Insurance Rate Maps.

According to studies by the National Institute for Standards and Technology (NIST) and the National Fire Protection Association (NFPA), functioning sprinkler systems (all but those rendered inoperable by human intervention) fail to operate when called

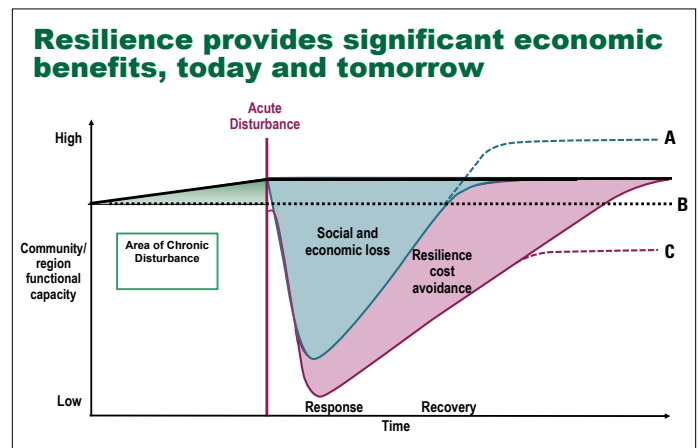


FIGURE 2. RESILIENCE LOSS RECOVERY CURVE


upon by fire (fire large enough to activate sprinklers) more than 15% of the time. Thus, trade-offs in passive fire protection are not an acceptable practice for achieving enhanced resilience. Although it sounds like an oxymoron, the international building codes permit fire walls to be made of combustible materials. For enhanced resilience, fire walls must be constructed of noncombustible materials, and reductions in fire resistance ratings due to the presence of sprinklers must be prohibited.

Storm shelters have clearly demonstrated their ability to provide life safety during high wind events. FEMA advises that even for most tornadoes, there is usually at least five minutes notice to seek shelter. The international building codes reference design and construction criteria for storm shelters where present, but unfortunately do not provide guidance as to where storm shelters should be placed. Enhanced resiliency simply requires storm shelters for all buildings unless there is adequate, accessible shelter within ¼ mile.

## What does this mean for you, the producer?

Assuming you produce a quality precast concrete product, there’s nothing for you to do to make your product more resilient. It’s inherent in precast concrete. But you must encourage these forward-thinking communities to adopt resiliency into their building specifications.

NPCA is travelling across the country participating in disaster-resistance workshops to further help community leaders recognize and assess local disaster risks they may face, evaluate mitigation measures based on the consequences and potential of those risks, understand the importance of incorporating fortified building programs into construction techniques, and to solidify their knowledge of safe rooms, storm shelters and disaster-resilient concrete systems such as precast concrete.

NPCA is a member of the Concrete Joint Sustainability Initiative (CJSI) and is also partnering with other concrete industry members to encourage enhanced resiliency. 

*Claude Goguen, P.E., LEED AP, is NPCA’s director of Technical Services.*

# STRENGTH IN UNITY

The twin towers of the Lewis and Clark Confluence Tower work together to achieve a unique design and a capacity for withstanding severe seismic stress and wind loads.

BY DEBORAH R. HUSO



In 2000, with the bicentennial celebration of the 1803-1806 expedition of Meriwether Lewis and William Clark approaching, the village of Hartford, Ill., wanted to mark the event in a meaningful and enduring way. It was there, at Camp River Dubois, that Lewis and Clark launched their “Corps of Discovery” exploration of the Louisiana Purchase within sight of the confluence of the Mississippi and Missouri rivers, the third-largest river confluence in the world.

The village held a series of ad hoc community meetings to design a tower that would offer views of the rivers’ confluence and also memorialize the historic partnership between the two explorers.

The project was funded entirely by grants and private donations, but because of the challenges of acquiring the funding, the confluence tower, associated park area and museum, took many years to complete. Even though the village of Hartford broke ground on the project in 2002, it was not officially completed until 2010. The towers stood, fully erected, for several years without handrails on the stairs while the village of Hartford worked to acquire more funding to complete the entire park project.

But this was to be no ordinary tower. It needed to reflect the symbiotic relationship of the two explorers it sought to memorialize. The friendship and partnership between the two explorers was the basis for the tower’s design.

Consisting of two shafts of equal size and height, one representing Lewis, the other representing Clark, the towers rise 19 stories or 190 ft with one shaft containing an elevator, the other a stairwell. Three viewing platforms join the three towers at 50, 100 and 150 ft, symbolizing the working partnership of the two explorers.

Apart from serving as lookouts, the viewing platforms also serve a structural purpose: They allow the tower shafts to work interdependently much like the explorers they symbolize.

In an unusual design, the precast concrete panel fins that achieve the tower’s fluted look increase in size as tower elevation increases, establishing a sense of openness at the top of the structure. To create the fluted look, High Concrete Group LLC of Denver, Pa., the precaster for the project, cast the panels using self-consolidating concrete (SCC).

There were only a few different panel shapes and sizes in the project, with the structural panels that make up the towers’

## The platforms were pivotal to the tower's structural design, particularly for maintaining the square shape of the elevator tower.

sides accounting for more than 170 of the pieces. These panels were more than 1 ft thick and consisted of varying dimensions of the same shape that increased slightly in size to create the fluted expansion of the towers as they grew higher.


Connecting all of the panels offered a small challenge. The design-build team had to consider how to connect the rebar between the precast panels. The idea was to vertically align the connecting precast panels by aligning the splice sleeves at the base of each panel with the projecting vertical reinforcing bars at the top of the precast panel below. The structural engineers considered the joining of the panels critical to the ability of the tower to withstand seismic stress given its location within the New Madrid seismic zone.

Like the towers, the viewing platforms increase in size as the tower height increases. The lowest one is 32 ft across and the highest, at 150 ft, is 36 ft across. The platforms were pivotal to the tower's structural design, particularly for maintaining the square shape of the elevator tower. Unlike the stair tower, it did not have internal diaphragms. Because it is so difficult to attain a moment connection at the inside corners with vertical precast panels, the connection of the three observation decks to the tower wall panels helped to maintain the square shape. The decks also keep the towers from rotating in high winds, removing the potential for structural twisting.

The decks themselves presented problems because of their size. As one precast unit, each deck would have been too large to transport by truck, so each one was cast as two pieces with support from a single center connector beam that spanned the space between the two towers. Both platforms are semi-cantilevered as well.

The tower's tall and narrow design, however, promised challenges with regard to wind-load carrying capacity as well as response to seismic activity. Before tower construction even began, designers subjected the structure's plans to wind testing to make sure the design could withstand severe weather and geologic events and to establish the human comfort level at the various viewing platforms in the event of high winds.

The completed structure consists of 256 precast panels weighing in at about 4 million lbs, and comprising 24,700 sq ft. The tower portion of the project cost \$4.8 million with the cost of the precast accounting for about \$1.35 million.

The Lewis and Clark Confluence Tower held its dedication ceremony Sept. 23, 2010, on the anniversary Lewis and Clark returned to the site at the close of their journey to the Pacific Coast. 

*Deborah R. Huso is a freelance writer who covers home design and restoration, sustainable building and design, and home construction.*

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People & Products is a forum where NPCA members and nonprofit organizations can share information on new products, personnel promotions/acquisitions or service announcements concerning the precast concrete industry. Items are printed on a space-available basis. For possible inclusion, send your press releases and photos to NPCA. Attn: Precast Inc. magazine, 1320 City Center Drive Suite #200, Carmel, IN 46032 or email them to [rhyink@precast.org](mailto:rhyink@precast.org).

### Wilbert Precast offering marketing videos

Wilbert Precast Inc., based in Spokane, Wash., has created a set of marketing videos detailing some of the procedures it uses to make concrete and is making them available to others.

With these videos, a company can have complete branding with its logo and contact information to use for its own marketing purposes. Wilbert says it has found the videos to be invaluable in Lunch & Learn environments and other similar situations, where they visually educate the customer and establish conversation about precast concrete.

For more information, email Leighton Miles at [leighton@wilbertprecast.com](mailto:leighton@wilbertprecast.com), or call (800) 888-4573.

### New Hampton Metal Fab to represent Streamline Automation

New Hampton Metal Fabrication, a leading manufacturer of form equipment for the precast concrete products industry based in New Hampton, Iowa, has reached an agreement to represent Streamline Automation in North American markets.

Streamline Automation offers the most complete line of styrene foam-cutting equipment on the market, says the company, especially milling channels for manhole inverts. Streamline also works with its clients to help them take their production processes and their



NEW HAMPTON METAL FAB IS NOW REPRESENTING STREAMLINE AUTOMATION EQUIPMENT.

businesses to new levels.

New Hampton Metal Fab has been serving various industries for more than 60 years, specializing in manhole, box, utility, flare, safety end, pipe and specialty product form equipment. The company is also the North American representative for Colle S.p.a., which offers a wide range of fully automated and manual machines for vibration machinery, packerhead machinery, vibration tables, wire cage machines and automatic pallet cleaning machines for the pipe and precast industry.

For more information, call (641) 394-4111 or visit [www.newhamptonmetalfab.com](http://www.newhamptonmetalfab.com).

### Smith-Midland introduces Sierra Wall II

Smith-Midland Corp., a licensor and manufacturer of precast concrete products, pioneered the use of precast concrete highway sound walls in the United States in 1980 with its Sierra Wall. Now the company and its licensing subsidiary Easi-Set Worldwide are introducing the Sierra Wall II, which features a fully integrated, one-piece, prestressed extended column and sound panel.

The inclusion of the foundation portion of the column, which extends up to 24 ft or more into the earth, sets Sierra Wall II apart from its competition, says the company. According to the American Association of State Highway and Transportation Officials guidelines, this patented design eliminates the need for costly heavy-steel reinforcing cages around the prestressed foundation portion of the column.

The combined strength of the integrated supporting/foundation column and panel delivers the highest-quality and lowest-cost highway sound wall ever offered, it says. The one-piece design also eliminates thousands of linear feet of panel joints, adding significantly to



SIERRA WALL II

its sound attenuating capacity versus competitive sound wall systems. Sierra Wall II is available worldwide for licensing to qualified precasters. For licensing inquiries, contact Moffette Tharpe, Easi-Set, at (800) 547-4045 or [mtharpe@easiset.com](mailto:mtharpe@easiset.com). For highway project inquiries, contact Matthew Smith, Smith-Midland, at (540) 439-3266 or [msmith@smithmidland.com](mailto:msmith@smithmidland.com).

### CERATECH introduces two new cements

CERATECH Inc., a commercialized green cement manufacturer based in Alexandria, Va., has introduced two new cement systems: KEMROK and FIREROK.

KEMROK cement demonstrates higher durability, is carbon free, and provides superior performance over portland cement when exposed to sulphuric acid, says the company. Maintenance managers at industrial facilities have reported much greater durability and higher corrosion resistance with KEMROK, and are projecting a significant reduction in maintenance shutdowns. KEMROK's corrosion resistance results in a life cycle that is two to three times greater than conventional portland cement products, according to the company.

FIREROK is a durable, high thermal-resistant cement for structural concrete. FIREROK cement for structural concrete withstands intermittent temperatures as high as 1,850 F and sustained



temperatures up to 570 F without significant loss of strength, says the company. The combined thermal and corrosion resistance of FIREROK makes it a perfect fit for extreme conditions, and its durability provides a lifecycle three to five times longer than any portland product.

All CERATECH cements are comprised of a dense crystalline structure that dramatically improves thermal resistance and are more durable in caustic and corrosive chemical environments. For more information about CERATECH, visit [www.CERATECHinc.com](http://www.CERATECHinc.com).

### Spancrete project manager to take on residential sales role



CHRIS HENDRICKSON

Spancrete, a designer, manufacturer and distributor of precast, prestressed concrete products based in Waukesha, Wis., has announced the move of project manager Chris Hendrickson to a new residential sales role.

Hendrickson, a former multifamily residential developer and builder, has been with Spancrete since June 2011. He holds a degree in accounting and management information systems from the University of Wisconsin-Milwaukee.

Spancrete has increased its focus on the residential market and realized an opportunity for growth through fostering relationships with key builders and homeowners in the Wisconsin and Illinois markets. Hendrickson's new role is vital to that growth of this already strong and expanding portion of Spancrete's business, says the company.

For more information about Spancrete, visit [www.spancrete.com](http://www.spancrete.com).

### BASF introduces new tool for measuring the value of consistent concrete

The Admixture Systems business of BASF's Construction Chemicals division has announced an addition to its suite of

electronic tools for concrete producers. The Consistent Concrete Value Tool (CCVT) was developed to model the dollar savings potential a concrete producer can achieve with more consistent concrete.

Consistent concrete requires minimal to no on-site adjustment of the concrete mixture or to the casting, consolidating and finishing processes on a batch-to-batch or day-to-day basis. This results in consistent hardened properties and eliminates placement delays due to job site adjustments.

The CCVT utilizes producer inputs and market data to calculate the value estimate. The producer identifies certain situations that may occur on the job site to determine how they affect the bottom line. The final product is a value estimate that can be printed to demonstrate the savings that can be achieved with consistent concrete. In addition, the tool identifies the ways in which consistent concrete can contribute to sustainable construction.

More than 125 CCVT evaluations have been conducted to date in North America. A six-minute video provides further explanation of the e-tool and summarizes the consistent concrete value results from these interviews. For more information, visit [www.basf-admixtures.com](http://www.basf-admixtures.com).

### BASF engineer receives prestigious award from Purdue University



DR. CHARLES NMAI

The Admixture Systems business of BASF's Construction Chemicals division announced that Charles Nmai, Ph.D., PE, FACI, was recently honored with the Civil Engineering Alumni Achievement award by the faculty of the Purdue University School of Civil Engineering. The prestigious award is presented to select graduates who have had outstanding career achievements and have made major contributions to the

civil engineering profession.

Nmai received his award April 12 at Purdue University among faculty, students and his family. He received his doctorate in civil engineering from Purdue in 1987, and has been employed by BASF Construction Chemicals since then. He currently serves as engineering manager responsible for providing technical leadership and strategic guidance in the marketing of admixtures and high-performance concrete technologies.

In addition to his work at BASF, Nmai is active in industry associations.

### UTA receives grant to study alternative reinforcements

A University of Texas at Arlington civil engineering professor has received a \$96,000 grant from BASF Construction Chemicals to study the feasibility of using synthetic and steel fibers as alternative reinforcements in precast concrete structures.

Ali Abolmaali, the Tseng Huang Endowed Professor of Structural Engineering and Applied Mechanics, said the grant with the Germany-based company is the first of its kind at UT Arlington. The experimental testing program will include both material and full-scale structural tests on precast concrete structures of different sizes.

Abolmaali's research represents the cutting-edge innovation developed at The University of Texas at Arlington, a comprehensive research institution of 33,500 students in the heart of North Texas. Visit [www.uta.edu](http://www.uta.edu) to learn more.

### Hyster announces two new additions in southeastern U.S.

Hyster Co., an operating division of NACCO Materials Handling Group Inc. based in Greenville, N.C., has announced that Briggs Equipment and LiftOne will open their doors as authorized Hyster lift truck dealers in Atlanta and Charlotte, respectively.

The additions make both Briggs and LiftOne two of the largest Hyster dealers in the United States, both responsible for the majority of the southeastern United States. Briggs' territory to sell and service Hyster brand lift trucks

includes Florida, Arkansas and Atlanta, and portions of North Carolina, South Carolina, Georgia, Alabama, Mississippi and Tennessee. LiftOne will be responsible for portions of Alabama, Georgia, Tennessee, North Carolina and South Carolina.

For more information about Hyster, visit [www.hyster.com](http://www.hyster.com).

### Scale-Tron increases U.S. presence

Scale-Tron Inc., a manufacturer of systems and controls for the concrete industry based in Montreal, has



MARC LARIN

increased its U.S. presence with the addition of Marc Larin.

Larin served Scale-Tron as a project engineer after graduating from engineering school. After several years as a professional

engineer with a local instrumentation company, he took a position with Sony Ericsson Communications in North Carolina, finally starting his own business. He has now joined Scale-Tron as technical sales specialist.

From his base in North Carolina, Larin will be responsible for technical sales and support for all products, including Scale-Tron automation systems, moisture controls and silo weighing, as well as Ocmer mixers and plants, in the important Eastern Seaboard area. Contact him at [marc@scaleton.com](mailto:marc@scaleton.com) or at (919) 522-8848.

### Dayton Superior launches two industry apps

Dayton Superior, based in Dayton, Ohio, is launching two new, free mobile applications (apps) that will allow customers in the concrete construction industry to access product and technical information on demand. The Dayton Superior apps are currently available for Android and iPad/iPhone users. The

two apps are named Dayton Superior Searcher and Dayton Superior Calculator.

Dayton Superior Searcher, available free in the Android Market and the iTunes App Store, provides users with a wide range of detailed information about the company's products including material safety data sheets, technical data sheets, product information, list price information, product bulletins and success stories.

Dayton Superior Calculator, available free in the Android Market and coming soon to the iTunes App Store, allows customers to easily determine the amount of grout required to cover a variety of shapes.

In addition, for smart phone users, both apps include a feature where a touch on Dayton Superior's telephone number within the app will connect immediately to customer service. These apps are available on the Dayton Superior website at [www.daytonsuperior.com/Apps](http://www.daytonsuperior.com/Apps) or by going directly to the Android Market or iTunes App Store and searching Dayton Superior.

### Dayton Superior Delta Tie achieves critical fire test ratings

Dayton Superior has announced that the Delta Tie, an insulated concrete panel connector, has achieved the desired fire ratings prescribed in the NFPA 285 fire test and, most recently, the ASTM E-119 fire test.

The Delta Tie underwent NFPA 285 fire testing in April 2012. The test, developed by the nonprofit National Fire Protection Agency, assesses combustible components used in noncombustible wall panels and assemblies. The test simulates the flammability and fire performance of multistory exterior wall assemblies.

The second phase of fire testing of the Delta Tie occurred in early May 2012



DAYTON  
SUPERIOR'S  
DELTA TIE

with the ASTM E-119 fire test. This test evaluates the duration building elements are able to contain a fire and/or retain structural integrity during exposure to a standard fire, controlled to reach specified temperatures over a four-hour time period.

The successful completion of these industry-critical fire safety tests proves the Delta Tie is able to withstand direct and indirect exposure to flame and temperature extremes without loss of structural integrity, says the company.

The Delta Tie uses an engineered composite matrix consisting of a geometrically configured, two-dimensional truss from continuous-wound fiberglass embedded in an alkali-resistant resin. For more information, visit [www.daytonsuperior.com](http://www.daytonsuperior.com).

### Bilco partners with Menards, expands presence in Midwest

The Bilco Co., based in New Haven, Conn., has announced a new partnership with Menards, a chain of well-known home improvement stores throughout the Midwest. Menards offers a complete selection of high-quality, name-brand merchandise, tools, appliances, and lawn and garden supplies.

As homeowner and contractor buying habits evolve, Bilco plans to evolve with them and make its products available through these types of retailers, the company says.

Bilco's entire line of residential products will be available, including StakWEL and ScapeWEL window wells and Classic and Ultra Series basement doors, including Classic Series steel doors featuring Bilco's new powder coat finish option. Products will be available through Menards' 268 retail locations and via [www.menards.com](http://www.menards.com). Customers will find Bilco literature in each location and can place an order for delivery right to their local store.

For more information on Bilco's complete line of residential access products, visit [www.bilco.com](http://www.bilco.com). ■