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SOMETHING FROM NOTHING

CONCRETE SYSTEMS INC.

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Educate, Advocate, Engage

BY MIMI RAINERO COLES | *Chairman, National Precast Concrete Association*

As we head into the last quarter of 2013, the construction economists have completed their number crunching and are publishing their economic forecasts for the coming year. The trend for 2014 will likely be heading in a positive direction, but it's not a stretch to note that the manufacturing sector of the economy has been severely stressed in recent years. The pressures on small manufacturers – like most precast concrete producers – are almost unimaginable these days. As precasters, we deal daily with challenges that include the uncertainty of future health care obligations, growing OSHA mandates, heavy-handed EPA regulations and, unfortunately, unscrupulous business practices by unqualified producers.

But even with all of those concerns, when you talk to most longtime precasters, they'll tell you they wouldn't want to do anything else. It's a rewarding business, and what makes it rewarding are our employees, the relationships we've built over the years and the places our businesses occupy in the community. We're manufacturers with a strong presence in most communities. We employ local people. We utilize locally sourced materials. Most of us contribute to our communities as volunteers and through support of youth programs and other service activities.

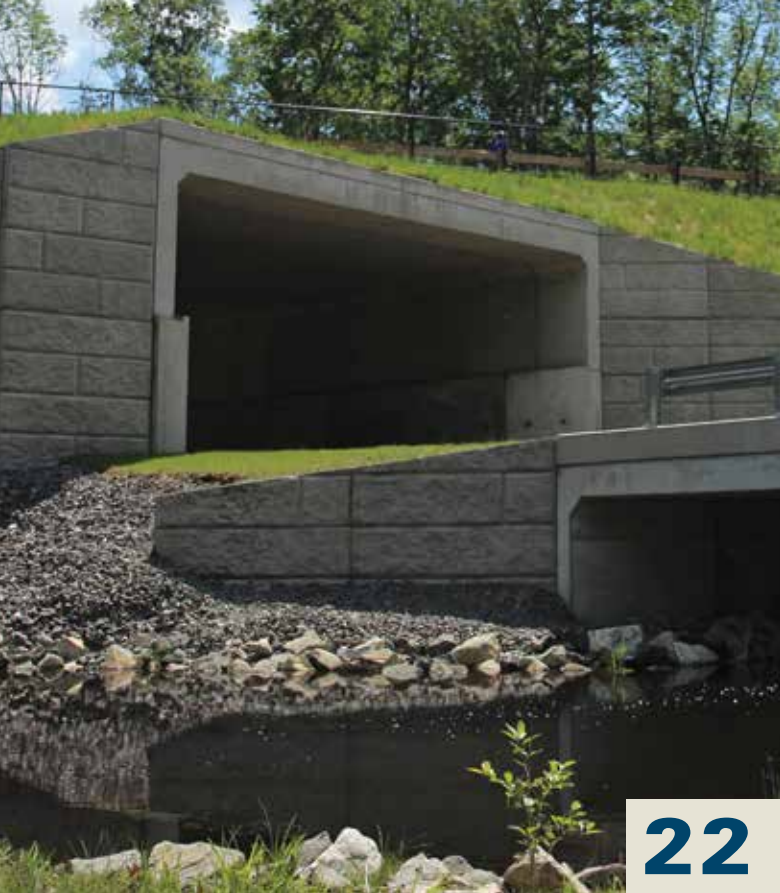
We are proud to be United States and Canadian manufacturers! We still manufacture products here in our plants in North America, and our production facilities keep people working, keep contributing to our communities and continue to provide tangible products of value utilized in the construction and maintenance of our vitally important infrastructure! As the economic forecast trends in a positive direction, there are opportunities ahead for us as manufacturers, but we face a very different environment than six or seven years ago.

The days when you could fill orders just by answering the phone are gone. In this new economy, we have to think outside the box and find ways to build our businesses beyond just making sales. Reaching out to our elected officials

to educate them on what we do and how our plants operate or to show them how fly ash, for example, can be repurposed into the concrete mix rather than sloughed off to a holding pond or landfill. We need to connect with specifiers and contractors on a personal level – making visits to their offices and bringing them into our plants to educate and advocate. We need to engage with our municipalities, our statehouses and our national government on policymaking. Anybody who has been paying attention knows that the infrastructure is failing. As precasters, we can make a strong case for precast solutions that offer not only long service life, but resiliency in disaster-prone regions and sustainable opportunities for LEED builders.

We have a wonderful story to tell! A long and successful history of manufactured products that have and will help build our countries – roads, bridges, drainage systems, buildings – the list goes on and on! We need to be telling our story – because we can tell it best!

A strong marketing program will be a critical requirement for success in the new hyper-competitive construction environment, and the National Precast Concrete Association is set to unveil an exciting new set of marketing tools for its members this fall. That program, combined with a national marketing push from NPCA, will continue to enhance our visibility and viability and will strengthen the relationships we maintain with government officials, specifiers and contractors – the people who determine what materials are used in jobs. If we combine strong marketing with strong relationships, then we're well-positioned to be the local, sustainable, job-producing infrastructure builders in our communities. If we educate, advocate and engage, we have a bright future indeed as a dynamic precast concrete sector on the edge of a growing modern construction industry. ■



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PROFILE

Something from Nothing

A “triple bypass” of overpass, underpass and culvert is one of the many precast projects originating from Concrete Systems Inc. in Hudson, N.H. The company, founded by Len Worden in 1972, has grown from a dry-cast manhole producer to a diverse precast manufacturer that distributes to all six New England states. Len’s son Mike now runs the company and has continued to grow and diversify it, and has also remained involved with NPCA just like his father, who is a past chairman of the board and a Yoakum Award winner.

Story and photo by Kirk Stelsel

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Photo courtesy of Portland Cement Association (cement.org)

How to Read a Cement Mill Certificate **PART 2**

Rather than filing and forgetting after the cement delivery, use the mill certificate to your advantage.

BY LARRY ROBERTS AND TERRY HARRIS

In this second part of a two-part series, we pick up the discussion from the July-August 2013 issue of *Precast Inc.* As you recall, we discussed what a mill certificate is, and how the data are gathered and reported. We also talked about the importance of tracking the results to control variability, and reported on compositional tests such as alkali content and Blaine fineness. In case you missed that discussion, you can find it on NPCA's website at precast.org/cementmill, or simply scan this QR code with your smart phone or tablet.

Next in our discussion comes an alphabet soup of C_3S , C_3A and SO_3 plus some of the performance tests. Refer to the example cement mill certificate on page 8 to follow the discussion.¹



SCAN TO VIEW PART 1 OF THIS SERIES

C_3S and C_3A , cement phase composition

C_3S (tricalcium silicate) is the major strength-producing phase in concrete curing and dominates through the first 28 days.

It would be tempting to say higher amounts of C_3S should yield higher strength, especially at an early age, but it is more complicated than that. These amounts do not reflect differences in reactivity that are determined by minor element inclusions in the crystals and the heat history in the kiln. So while the C_3S quantity is useful to the cement chemist who is tracking a specific cement and for determining specification compliance, a comparison should not be made between different cements on this basis alone.

It is useful to track the C_3S , however, and note any step change in a given cement. Sometimes the C_3S level may go down and the cement fineness may go up, or vice versa. These variations occur when the cement producer balances one factor with another to keep the performance as consistent as possible, and is to be expected. Large variations can have other effects, though, as discussed under fineness.

C_3A (tricalcium aluminate) is the most highly reactive element in cement, and its hydration components are changed in sulfate attack. This is why C_3A is limited in Types II and V cements. Calcium sulfate ($CaSO_4$) is added to cement to control this high-

reactivity component (SO_3 as indicated on the mill certificate). C_3A is not limited in Type I cement, so when a producer labels a cement mill certificate as “Type I/II” it really means it is a Type II cement that also meets the Type I requirements. The only restrictive difference between Type I and Type II cements is that Type I has slightly higher three-day and seven-day strength requirements, but as they are typically well below current market-determined strength levels, all Type II cements are essentially Type I as well.

What does C_3A tell us that we should track?

1. C_3A content can be an issue when early strength is important, as high- C_3A cements tend to be somewhat more reactive at an early age. A substitution of a Type I/II for a Type I must be approached with caution, because it is likely, although not inevitable, that early strength could be lower (even though they are nominally both Type I). This is where the mill certificate becomes useful. A change of around 1 to 3% in C_3A is unlikely to have a strong impact caused by this difference alone, but a switch from, say, an 11% C_3A Type I to a 4% C_3A Type I/II would be in the direction of lower early reactivity and should be carefully tested to assure that the performance for the application is acceptable. One example to consider in this case is sufficient strength gain for form removal.
2. Normal C_3A variation in a cement plant should not have a significant impact, but sometimes cement from the same plant can change. For example, purchasing clinker from another plant to make the cement may change the composition. In this case, the charting of the mill certificate data can prove to be a useful alert that early strength performance should be checked.
3. The C_3A level is also important in determining admixture dosage. Through some fairly complex chemistry, rapid-reacting C_3A hydration products can absorb many admixtures during early hydration. This is the source of the well-known “delayed addition effect” where admixtures, especially superplasticizers, can be made more effective by adding them later in the mixing sequence. This happens because it takes a few minutes for the sulfate in the cement to dissolve and control the C_3A reaction. Changes in the C_3A level of a cement can influence this effect, so it’s helpful to understand the normal behavior of the cement being used. If a significant C_3A change is noted, as in several percentage points, rechecking the admixture dosage requirement can be useful.

In some mill certificates, the other two major compounds – C_2S (dicalcium silicate) and C_4AF (tetracalcium aluminoferrite) – are listed as well, but since there are no specification limits on these, it is not required. These are often referred to as “potential” compounds, calculated by analyzing the elemental composition and assuming idealized chemical reactions in the kiln. Although this approach has been used for more than 70 years, more extensive testing has shown that these numbers are approximately, but not exactly, correct.

SO_3 , inorganic processing data

SO_3 (sulfur trioxide) is an indirect measure of the amount of gypsum or calcium sulfate (CaSO_4) in the cement. As discussed above, SO_3 helps control C_3A reaction. The amount analyzed consists of both the sulfate (SO_3) in the cement clinker and the amount added during grinding, typically in the form of the mineral gypsum. A few points are in order:

1. ASTM C150/C150M limits the amount of sulfate that can be added to cement of different types. In some cases, these default sulfate limits are too low for some concrete applications – for example, when the cement is used with certain admixtures or combinations of admixtures, with admixtures at high dosages, with Supplementary Cementitious Materials (SCMs) containing reactive alumina, and/or at higher temperatures. However, a cement producer cannot know in advance all of the mix designs and materials that a cement will be used with, and durability issues can arise with over-sulfated cements. Volumes have been written about this phenomenon. If the concrete system is under-sulfated, either a runaway setting or a severely retarded setting can result. In either case, significant depression of early strength results can occur. With recent changes in the ASTM specifications to allow higher levels of sulfate, so long as durability is maintained, this situation will be even rarer. But monitoring SO_3 levels on mill certificates can help identify potential sources of problems, particularly if problems arise in concrete production when new materials or combinations are being used (cement, SCMs or admixtures).
2. Since SO_3 is present to control C_3A , in a given cement the ratio of one to the other will normally be fairly constant. It is useful to plot this ratio, and if you note significant changes, ask the cement producer about the reasons for the change. If the ratio of $\text{SO}_3/\text{C}_3\text{A}$ drops significantly, say two to three times more than the normal lot-to-lot variation, beware of the setting issues described above.

Performance tests

The cement mill certificate includes three performance tests that merit close attention: false set, Vicat setting time and strength.

False set. False set is the tendency for cement mixtures to stiffen early, typically due to the sulfate in the cement reacting with the water to form gypsum crystals over the first few minutes of mixing. Because these are weak and can be broken up or redissolved with additional mixing, the term “false” is applied. The number reflects how much residual workability is present as measured by the difference in paste penetration resistance before and after two mixing steps at a specified time. Thus a higher number is better (a 50% minimum is specified in ASTM C150/C150M).

This can be very important in the precast environment, because the short mixing cycles frequently used may allow the false set to occur after discharge, making placement without

C150/C150M – 12

ABC Portland Cement Company
Qualitytown, N.J.

Plant Example

Cement Type II(MH)

Date March 9, 20xx

Production Period March 2, 20xx – March 8, 20xx

STANDARD REQUIREMENTS ASTM C150 Tables 1 and 3

CHEMICAL			PHYSICAL		
Item	Spec. Limit	Test Result	Item	Spec. Limit	Test Result
SiO ₂ (%)	^A	20.6	Air content of mortar (volume %)	12 max	8
Al ₂ O ₃ (%)	6.0 max	4.4	Blaine fineness (m ² /kg)	260 min 430 max	377
Fe ₂ O ₃ (%)	6.0 max	3.3	Autoclave expansion (%)	0.80 max	0.04
CaO (%)	^A	62.9	Compressive strength (MPa)	min:	
MgO (%)	6.0 max	2.2	1 day	^A	
SO ₃ (%)	3.0 max	3.2	3 days	7.0	23.4
Ignition loss (%)	3.0 max	2.7	7 days	12.0	29.8
Na ₂ O (%)	^A	0.19	28 days	^A	
K ₂ O (%)	^A	0.50	Time of setting (minutes)		
Insoluble residue (%)	0.75 max	0.27	(Vicat)		
CO ₂ (%)	^A	1.5	Initial Not less than	45	124
Limestone (%)	5.0 max	3.5	Not more than	375	
CaCO ₃ in limestone (%)	70 min	98	Heat of hydration (kJ/kg)		
Inorganic processing addition (ground, granulated blastfurnace slag)	5.0 max	3.0	7 days	^B	300
Potential phase composition (%) ^C			Test Method C1038 Mortar Bar Expansion (%)	^D	0.010 ^E
C ₃ S	^A	59			
C ₂ S	^A	11			
C ₃ A	8 max	5			
C ₄ AF	^A	10			
C ₄ AF + 2(C ₃ A)	^A	20			
C ₃ S + 4.75C ₃ A	100 max	83			

^A Not applicable.

^B Test result represents most recent value and is provided for information only.

^C Adjusted per **A1.6**.

^D Required only if percent SO₃ exceeds the limit in **Table 1**, in which case the Test Method **C1038** expansion shall not exceed 0.020 % at 14 days.

^E Test result for this production period not available. Most recent test result provided.

OPTIONAL REQUIREMENTS ASTM C150 Tables 2 and 4

CHEMICAL			PHYSICAL		
Item	Spec. Limit	Test Result	Item	Spec. Limit	Test Result
Equivalent alkalis (%)	^F	0.52	False set (%)	50 min	82
			Compressive strength (MPa)		
			28 days	28.0 min	^G

^FLimit not specified by purchaser. Test result provided for information only.

^GTest result for this production period not yet available.

Additional Data

Inorganic Processing Addition Data	
Type	Ground, granulated blast furnace slag
Amount (%)	3.0
SiO ₂ (%)	33.1
Al ₂ O ₃ (%)	10.9
Fe ₂ O ₃ (%)	1.1
CaO (%)	44.4
SO ₃ (%)	0.2

Base Cement Phase Composition	
C ₃ S (%)	63
C ₂ S (%)	12
C ₃ A (%)	5
C ₄ AF (%)	11

We certify that the above described data represents the materials used in the cement manufactured during the production period indicated.

Signature: _____

Title: _____

agitation (vibration) difficult or impossible.

False set may also be influenced by admixtures. Some admixtures can delay the onset of the gypsum precipitation, causing false set to occur where otherwise it would be prevented by normal mixing. Accordingly, tracking the false set number – and especially relating it to plant water demand records – can be very useful.

As we have seen with other parameters, it is very difficult to compare cements from separate sources on this basis, but tracking values for a cement over time can provide valuable information. The standard test method (ASTM C451) involves neat cement paste without SCMs or admixtures that may affect concrete performance. Nevertheless, if an increase in plant water demand corresponds to a decrease in the false set number, false setting may be occurring. Problems of this type usually can be overcome, sometimes by only a few seconds delay in admixture dosage or lengthening the mixing time. But early strength, and therefore plant efficiency, can be strongly impacted, so close monitoring is warranted.

The false set test is an optional requirement, but it is often reported anyway. If not, you should consider requesting it.

Vicat setting time. Vicat setting time is a measurement of how many minutes it takes for a concrete sample to set, as derived from a Vicat testing apparatus. Specification limits range from 45 to 420 minutes, and it is very unusual for a cement to be close to either extreme. The Vicat test (ASTM C191) is performed on a patty of cement paste at a very low water-to-cement ratio – typically in the range of 0.25, quite different from normal concrete. For that reason, while it is an indicator of concrete setting behavior, it should not be taken as a direct predictor. Cements with similar Vicat setting times can have different setting times in concrete, and conversely cements with different Vicat setting times can be similar in concrete. Moreover, since the Vicat test on plain cement paste does not capture any admixture or SCM effects, with today's almost universal use of SCMs and admixtures, concrete results can vary significantly. Again the emphasis is on change. Plot the results on a control chart, and if a significant change is seen, something has changed in the cement and you should be aware that concrete setting characteristics may change.

Strength. A number of factors limit the utility of strength test results on a mill certificate.

1. Types I, II and V cements require only three- and seven-day strength test results. Most mill certificates also report 28-day strength, but usually this is with the note that it is from an earlier time period or lot, for reasons discussed previously. Type III cements also require one-day strength to be reported. However, the specification requirements are generally significantly below actual strengths achieved, so they have little direct impact.
2. ASTM C109/C109M strength testing for portland cements is done at a constant water-to-cement ratio for a specific mortar composition, so the results do not reflect concrete strength

performance differences that may change due to the water demands of the concrete.

3. With the wide use of admixtures and SCMs, concrete strengths may be determined in large part by the response of these materials to the cement characteristics and to each other. Clearly, the impacts of other concrete parameters (for example, mixing intensity and aggregate characteristics such as nominal sizes, strengths and gradations), cannot be captured by C109 mortar testing.

For these reasons, it is not recommended to compare cement strengths of different cements from mill certificate results for selection purposes. The proof is in concrete, in the mixtures used. But again, changes in the reported cement strength of a cement being used may be reflected in the concrete, and therefore should be put on a control chart and tracked.

ASTM also provides a better means for a cement company to communicate the actual variation of the cement strengths at seven and 28 days (ASTM C917, "Standard Test Method for Evaluation of Cement Strength Uniformity from a Single Source"). If a cement producer can supply this test report, it is very useful, because the samples used are grab samples, not composites, and many are taken each month. The test results give a good idea of how much a particular cement's strengths vary on a short-term basis and thus may be more useful than the standard mill certificate. Several state DOTs require these strength reports, so they may well be available even if you have not requested them.

Conclusion

Obviously, the relation of cement composition and physical properties to concrete performance is a complex subject. We cannot expect average numbers like those on mill certificates to tell us everything, but it is useful to pay attention to them. Many field problems can be avoided by requiring the review and plotting of mill certificate data every time a cement shipment is received, and by being aware of the potential effects on concrete performance. ■

Larry Roberts (Roberts_Consulting_Group@verizon.net) is owner of Roberts Consulting Group LLC, Acton, Mass. Terry Harris (Terry.Harris@grace.com), of Green Cove Springs, Fla., is manager of Technical Services, North America with Grace Construction Products, Cambridge, Mass. The authors invite comments and questions at any time.

¹ A copy of the example mill certificate, courtesy of ASTM International, is available on NPCA's website at precast.org/certificate-example. ASTM C150/C150M is available for purchase from the NPCA Shop by calling (317) 571-9500 or toll-free (800) 366-7731.

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W. R. Grace & Co. (Grace.com)

Notwithstanding today's lean manufacturing environment, new requirements under the Globally Harmonized System prompt companies to provide obligatory safety training.

Framework for Safety

BY GEORGE CHELOVICH AND MICHAEL LADD

Increasing customer demands and requirements place an enormous stress on a precaster's ability to deliver high-quality products with shorter lead times. As a result, when combined with leaner supervisory and production staffs, the ability to develop and schedule environmental health and safety training has become much more difficult.

Yet the need for properly trained employees in the area of occupational health and safety is more important than ever, especially new employees. That's because OSHA has finalized its new Hazard Communication Standard (HCS),¹ aligning it with the Global Harmonization System (GHS) for classifying and labeling chemicals.

The new system substantially changes the existing HCS. Employers must train all employees on the new rules by Dec. 1, 2013. Additionally, employers must learn new chemical classification criteria, replace all Material Safety Data Sheets (MSDSs) with new Safety Data Sheets (SDSs), and update or replace chemical labels by the phase-in dates noted on OSHA's website. OSHA has developed a specific website to provide highlights and details that employers should be aware of and training requirements.²

Four steps to a safer workplace

With the new HCS training requirements in mind, let's take a look at a simple example of how a four-step process can be applied to the requirement for retraining.

Step 1 – Assessment. The first step is an analysis of the value that training brings to the business. There are many reasons to train workers: proper orientation; understanding of company standards, policies and procedures; regulatory compliance; prevention of accidents; and so forth. A quick assessment should be done to ensure that all are properly identified and prioritized.

The assessment process in this scenario is straightforward. Implementing HCS training provides value to the organization in two ways: It satisfies the regulatory requirement for training and thus reduces the probability and financial impact of an OSHA violation; and more importantly, it provides workers the opportunity to better understand the hazards of the materials used in the precast manufacturing process.

Step 2 – Development of training objectives. Training metrics should be created to evaluate the effectiveness of the training provided. Rather than focusing on the number of people trained or the total hours of training, define the impact you want to achieve as a result of the training. One of the key elements in occupational safety and health training is to teach employees the behaviors that will maximize production and minimize accidents.

In this example, the training objective is to ensure employees have the information they need to better protect themselves from chemical hazards in the workplace as new labeling

requirements and SDSs are being reformatted.

Training may be limited to a few people or given to the entire workforce. Some employees may be required to wear personal protective equipment (PPE), others may have PPE available to them and use it on a voluntary basis. In either case, the training should include a refresher on the application and use of PPE.

Step 3 – Determination of required employee behaviors.

The need to identify necessary employee behaviors and actions required at the job class level within your facility that will achieve the level of accidents, productivity and quality acceptable to your organization is critical. Once specific behaviors are identified, you can determine the right training methods that fit your organizational style.

The following is not a complete list of expected behaviors, but it illustrates the types of behaviors desired. Employers need to evaluate their production processes and create employee behaviors based on the machinery and equipment used, their production processes and skill levels of their workforces.

- Employees wearing the proper protective equipment and clothing
- Employees inspecting their PPE prior to use
- Employees using the proper tools in chipping, grinding and cleaning activities
- Employees using approved containers for chemicals/materials
- Employees reading SDSs on new chemicals and materials
- Employees promptly reporting problems, concerns and health effects

Step 4 – Testing and workplace application. Step four is to establish clear objectives for training that can be measured through testing and workplace application.

Requiring employees to determine the proper PPE needed in a specific scenario, inspect it and wear it can be one criterion

for passing the training.

There should be a post test and follow-up audit to ensure the effectiveness of the training. The post test should cover the main concepts of the training, specific requirements of the regulation, testing on the new label requirements and SDS formats, as well as the behaviors that will be expected after the training.

The follow-up audit would consist of an observation of employee work practices against the desired behaviors as well as short interviews with employees ensuring their retention on labels and SDSs. An employer may also measure the effectiveness by the number of employees observed wearing their PPE correctly.

If a high number of violations are observed in employee behaviors, knowledge of labels and SDSs, or PPE usage, then retraining should be considered.

The retraining requirement for the revised HCS can be summarized quickly in the following table:

STEP	ELEMENT	OUTCOME
1	Assessment	Increase awareness of health hazards with chemicals used in the production process; training required by OSHA
2	Training Objectives	Ensure employees have the information they need to better protect themselves from chemical hazards
3	Employee Behaviors	Ability to interpret labels and SDSs, use appropriate PPE, and set up safety work area
4	Testing	Testing activities will include a PPE usage test during training, a post exam and an in-plant audit observing behaviors

The new OSHA standards have placed high importance on HCS training, which, as mentioned earlier, must be completed

HOW EFFECTIVE IS YOUR SAFETY TRAINING?

A recent claim analysis by CNA Insurance of its manufacturing customers indicates that more than 40% of employee injuries occur to those with less than two years experience. In these competitive times, it is much more difficult for employers to spend three days in a classroom teaching the theories of occupational safety and health as they relate to their operations. Training in today's environment requires that employers use the most effective methods that can be accomplished in relatively short time periods.

A 2010 National Institute for Occupational Safety and Health (NIOSH) study on the

effectiveness of training and education for the protection of workers found that the most engaging methods of safety training are, on average, approximately three times more effective than the least engaging methods in promoting knowledge and skill acquisition. They also found that the most engaging methods of safety training are, on average, most effective in reducing negative outcomes such as accidents. They defined "engaging methods of training" as training activities that included behavioral modeling, simulation and hands-on training.

"Moderately engaging methods of training" consisted of programmed instruction techniques, including computer-based instruction and feedback techniques. The "least engaging methods of training" involved such activities as lectures, films and video-based training.

Their results suggested, however, that moderately and highly engaging training methods are, on average, more time consuming and probably more expensive in the short term but that they are potentially less costly and more effective in the long term while better ensuring worker and public safety

HCS PICTOGRAMS AND HAZARDS			
HEALTH HAZARD Carcinogens Mutagenicity Reproductive Toxicity Respiratory Sensitizers Target Organ Toxicity Aspiration Toxicity		FLAME Flammables Pyrophorics Self-Heating Emits Flammable Gas Self-Reactives Organic Peroxides	
		EXCLAMATION MARK Irritant (skin and eye) Skin Sensitizer Acute Toxicity Narcotic Effects Respiratory Tract Irritant Hazardous to Ozone Layer (Non-Mandatory)	
GAS CYLINDER Gases Under Pressure		CORROSION Skin Corrosion/ Burns Eye Damage Corrosive to Metals	
		EXPLODING BOMB Explosives Self-Reactives Organic Peroxides	
FLAME OVER CIRCLE Oxidizers		ENVIRONMENT (Non-Mandatory) Aquatic Toxicity	
		SKULL AND CROSSBONES Acute Toxicity (fatal or toxic)	

by Dec. 1, 2013. This four-step process is a simple example, but it provides one possible framework for your own training syllabus.

Ask your insurance carrier whether it can provide at least some of the safety training. This training may come in the form of classroom training, online training, ePresentations, webinars or any combination of these methods to fit your operation and

training objectives. No matter how you add it up, an effective safety program = a safer working environment = fewer incidents = minimal insurance costs. ■

George Chelovich, CNA Insurance Co., has been in the insurance industry for 36 years, 26 of which have been with CNA. He started as a field consultant, has held various field and staff management positions, and is currently the assistant vice president of Risk Control's construction, manufacturing and technology segments. His technical areas of expertise are workers' compensation, ergonomics and machine safeguarding.

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.

¹ The Hazard Communication Standard Final Rule is available for download as an 858-page pdf file at <https://www.osha.gov/dsg/hazcom/GHSfinal-rule.pdf>. Also see "GHS: A New World Order for Safety" in the January-February 2013 issue of *Precast Inc.*

² <https://www.osha.gov/dsg/hazcom/index.html>

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NPCA
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STEEL & CONCRETE: Yin & Yang

Forces and stresses – Do you understand the material properties behind the great success of reinforced concrete structures?

BY SUE McCRAVEN

Reinforced concrete is the yin-yang composite of building materials. An ancient Chinese science and philosophy, yin and yang are complementary, interacting forces that form a whole greater than their separate parts. Likewise, concrete and steel are totally different materials, but when combined, they create reinforced concrete, the best composite construction material in the world.

Separate strengths & weaknesses

Taken separately, concrete and steel have their respective strengths and weaknesses. We all know concrete is king of compressive strength. A block of 4,000 psi concrete can resist tremendous compressive forces. But if we stretch concrete out into more linear shapes, like beams, it cannot resist the tensile – or bending – forces that are created. This is because concrete's tensile strength is nil, at least for design purposes.

Fresh concrete is malleable as it flows into forms. It can be shaped into a myriad of designs, depending on the formwork geometry. New developments in formwork technology¹ are leading to unprecedented architectural designs. Integral color, new techniques for shaping concrete's surface, and the use of exposed granite and marble aggregates present designers with an endless array of exterior finishes and gorgeous facade possibilities.

Structural steel is extremely strong. But in addition to bearing tremendous tensile loads, steel has amazing ductility, and is therefore termed a "tough" material. Along with toughness, steel demonstrates an elastic range under stress – it can deflect under tensile forces without failure. But all by its lonesome, steel doesn't stand up to the forces of fire and water. Naked

steel is vulnerable to corrosion. Also, let's face it: Plain structural steel has practically no aesthetic appeal – unless you like rust.

Stress & material properties

All engineers are taught that, in order to build with reinforced concrete, they must first understand the individual material properties of concrete and steel. For design purposes, normal-weight concrete has a density of approximately 145 lb/cu ft, and its compressive strength is about 4,000 psi. For various compressive strengths, graphs of concrete stress (in kips per sq in., or ksi)² versus strain (change in length divided by the original length) demonstrate a linear relationship up to the point where the strain measures around 0.002. This means that when forces

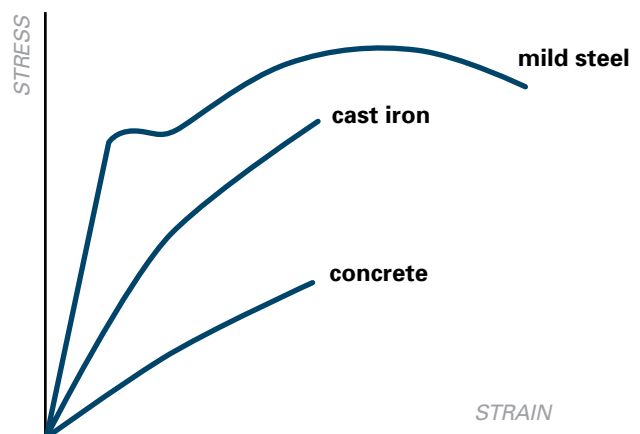


FIGURE 1: GRAPH OF STRESS-STRAIN CURVE FOR CONCRETE AND STEEL

create a strain of 0.002 or greater, the direct relationship (the straight line portion of the graph in Figure 1) between stress and strain is lost.

Concrete's modulus of elasticity varies with compressive strength, loading, and the characteristics of the cement and aggregate. Concrete's modulus of elasticity is taken from the slope of the stress-strain diagram in Figure 1, whose values are based on actual compressive tests of 28-day-old cylinders.

Reinforcing steel is taken as Grade 60. This means the rebar in reinforced concrete has a yield strength of 60 ksi, which represents the steel stress that corresponds to a strain of 0.35%. The nominal weight of a No. 3 bar is 0.376 lb/ft and 0.668 lb/ft for No. 4 bar. The modulus of elasticity of steel is taken as 29×10^6 psi for design purposes.

Forces

Once we have a feel for the material characteristics of concrete and steel, we try to determine the anticipated loading that reinforced concrete must resist in service.

Dead loads. Dead loads are easily calculated using density, mass and volume. Dead loads are static, unchanging or permanent forces, such as:

- Self weight of steel-reinforced concrete
- Building or superstructure loads
- Soil pressure

Live loads. More difficult to calculate, live loads are often unpredictable and vary in their intensity and magnitude.

Examples include:

- Wind forces
- Snow and ice loads
- Seismic forces
- Construction and traffic loads

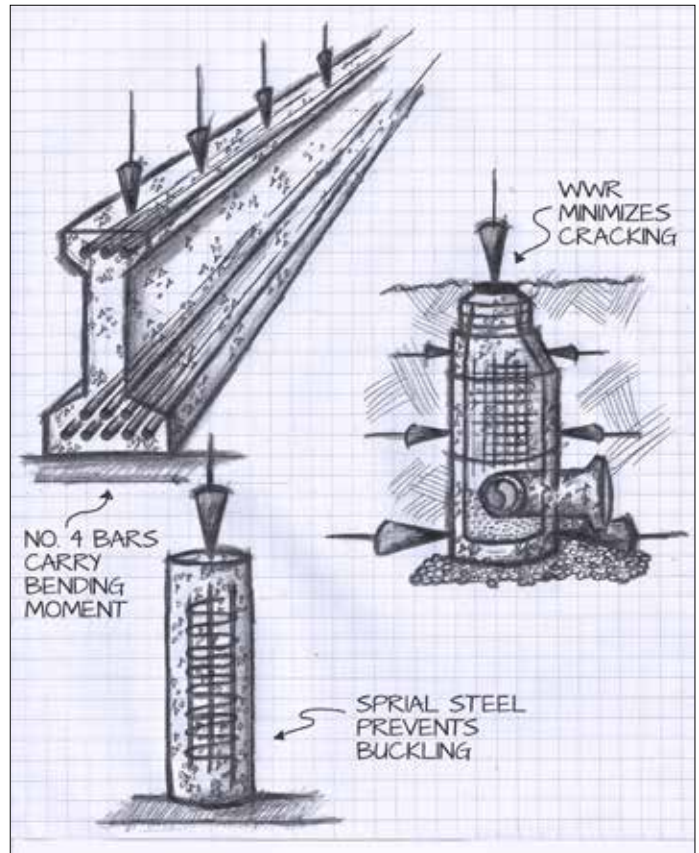
Advantages

Reinforced concrete's superior advantages as a construction material are:

- Strength and ductility
- Fire resistance
- Water resistance
- Low maintenance
- Long service life
- Recyclability
- Design flexibility
- Most economical foundation structures
- Thermal efficiency

United strength in service

When concrete contributes its renowned compressive strength with steel's unmatched toughness and ductility, it becomes a dynamic duo, a structural workhorse – the ultimate yin-yang composite. And its proven dependability and durability over time have earned reinforced concrete its position as the most preferred building material in the world.



Its combined material strengths, however, wouldn't matter at all without one shared characteristic: similar coefficients of thermal expansion. As the mercury rises and falls, in the tropics or in the Arctic, steel and concrete not only bond to each other, they move in perfect unison with each other! In his book, "Design of Reinforced Concrete,"³ J.C. McCormac captures this structural synergy better than anyone:

"Concrete and steel work together beautifully in reinforced concrete structures. The advantages of each material seem to compensate for the disadvantages of the other. For instance, the great shortcoming of concrete is its lack of tensile strength; but tensile strength is one of the great advantages of steel.

The two materials bond together very well so there is no slippage between the two, and thus they will act together as a unit in resisting forces."

There you have it: the yin and yang beauty of reinforced concrete. ■

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

¹ See "Breaking the Mold: Explorations Shaping Architectural Precast," by Matt Roper, M.Arch., in the Spring 2013 issue of *Precast Solutions*.

² A kip = 1,000 lbs

³ McCormac, J.C., "Design of Reinforced Concrete," 2nd edition, Harper Collins Publishers Inc., 1986. The 9th edition of McCormac's book, co-authored by Russell H. Brown, is currently available.

TOM MONTALBINE, PRESIDENT OF ROMAN STONE CONSTRUCTION CO., VIEWS THE VANDALISM AND THEFTS AT HIS PLANT AS LESSONS LEARNED, AND HAS SINCE STEPPED UP HIS SECURITY MEASURES.
NPCA file photo



THE 'INSIDE' JOB

How to prevent theft and other losses at your precast manufacturing plant.

BY BRIDGET McCREA

“THEY TOOK ANYTHING THAT WAS METAL AND THAT YOU CAN SELL.”

— Tom Montalbine, Roman Stone Construction Co.



The brazen thieves hit not once, but twice at Roman Stone Construction Co. of Bay Shore, N.Y. Using the cover of darkness to do their dirty deeds, they broke into the precast manufacturer’s plant, cutting all welding cables and cleaning out the company’s valued assets as they made their way through the facility.

“They took anything that was metal and that you can sell,” says Tom Montalbine, president of the 35-employee organization. Nothing was safe from the crooks’ hands – small tools, copper wiring and many other operation-critical items went out Roman Stone’s door that night. But the precaster’s troubles didn’t end there. The initial break-in took place on a Thursday night in mid-March, and the same thieves struck again the following weekend.

This time the thieves – evidently more educated and knowledgeable about their target – spent even more time vandalizing equipment, stealing tools and absconding with raw materials. “They must have spent hours in here ripping out every piece of copper wiring we owned,” Montalbine explains. “They also smashed our batch computer and vandalized our expensive batching equipment.”

The second hit impacted the precaster even harder than the first. In fact, all employees had to be laid off until the damage could be assessed, the insurance adjusters could do their jobs, and the plant could be repaired to the point of being able to make product again. Without much help from local police – who basically just wrote a report but didn’t do any “CSI-like” investigating, according to Montalbine – the precaster was left to his own devices to 1) get back up and running, 2) figure out who the culprits were, and 3) shore up his facility to ensure that the same crime wouldn’t happen again.

Montalbine says it took one day to fix the batch machine but notes that even months later his employees are discovering that items pertinent to the firm’s operations are missing. “Just the other day I was looking for a handsaw that was evidently swiped during the operation,” says Montalbine. “It’s been extremely disruptive to our operations.”

Finding the culprits would prove more challenging for the precast manufacturer, which posted signs offering a reward for any information related to the crime. One thing he believes is that it was an inside job – based on how well the thieves knew the facility, where everything was and where the cameras were located. He’s since hired a private investigator to look into both break-ins.

Montalbine says some of the best advice he’s received came from the owner of an adjacent asphalt plant, who told him “not to discount any information that you receive or any hunch that you might have.” Even a longtime employee, for example, could be a suspect when such crimes occur. “He told me not to overlook even my most trusted worker,” says Montalbine, “knowing that he or she could be the one involved.”

To shore up Roman Stone’s facility and ensure that the same problem doesn’t occur again, Montalbine has installed more interior cameras throughout the plant to augment those that were already installed on the facility’s exterior. He’s also adding more exterior facility and street lighting – particularly around the areas where the break-in occurred. A wiser Montalbine says he’s also educated himself on the fine points of dealing with break-ins and other thefts that can quickly erode a company’s bottom line.

“After learning that about 25 percent of companies have fallen victim to embezzlement – many times unbeknownst to the firms’ owners – I realized that theft, vandalism and internal theft can really happen to anyone,” says Montalbine. “For most of us, it’s not a matter of if it will occur; it’s a matter of when it will happen.”

Assessing the vulnerabilities

Regardless of size, all precast manufacturers are vulnerable to theft fraud and other debilitating threats that can literally take down an entire plant for days, weeks or even months. Whether

THIEVES RIPPED OUT COPPER WIRING, SMASHED THE BATCH COMPUTER AND VANDALIZED THE BATCHING EQUIPMENT. Photos courtesy of Roman Stone Construction Co.

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the crime is embezzlement, robbery, vandalism, inventory theft or computer crime, some of the threats can continue unchecked for years. The employee that siphons diesel out of a work truck on a weekly basis, for example, can wind up costing the company thousands of dollars in lost fuel over the period of a year.

Bob Chartier, vice president of key accounts at security personnel contracting firm AlliedBarton (alliedbarton.com) in Conshohocken, Pa., works often with manufacturers and says one of the best first steps to thwarting crime is educating employees about company policies, procedures, possible "criminal sightings" and other potentially damaging behaviors. By adopting a New York City-like "If you see something, say

REDUCING BUSINESS CRIME EXPOSURE

Criminal attacks against companies take many shapes and forms. Accountants who pilfer small amounts of cash over long periods, outsiders who break in and steal valuable equipment and materials, and computer hackers who steal private information and shut down servers can all cripple a precaster's operations and bring the company to its knees.

In its "Guide to Preventing Workplace Fraud," Chubb Insurance (chubb.com) based in Warren, N.J., advises firms to develop a fraud risk management program that includes loss control measures. This is critical to the detection, mitigation and prevention of fraud-related risks. Loss control measures need to take into account the company's industry, corporate structure and organization, geographic locations, customer base, vendor relationships and regulatory environment.

Chubb Insurance says an effective risk management program may include the following types of internal controls:

- 1. Employee background screening, especially for employment applicants for positions involving trust, such as handling cash, inventory, and financial statements and records.** Screening of potential employees should involve checks of criminal history, credit reports, verification of employment and education, and drug testing. An employee screening program should be commensurate with the company's

fraud risk and take into account applicable legal considerations.

- 2. Customer feedback, reports and complaints.** Companies often pay little attention to feedback from their customers, vendors and other external sources. Yet ignoring this feedback can result in a failure to detect and respond to possible fraudulent activity.

- 3. Effective oversight.** Monitor, review and supervise financial-related activities on a regular basis at multiple levels, including account reconciliations, exception reports, trend analysis, budget and/or plan variance analysis, and audits.

- 4. Mandatory vacation policies.** Require employees who hold financial positions to take regularly scheduled vacations, and do not allow them to conduct company business while on vacation.

- 5. Fraud reporting, awareness and deterrence programs.** Generate a program that will facilitate the reporting of suspected fraud by employees and others. Include training employees, and even vendors, in the fraud risks that threaten your business. This training should focus on identifying warning signs ("red flags") of potential fraud. Create a "perception of detection." A reputation for aggressively investigating indications of fraud can have a strong deterrent effect. On the other hand, a reputation for ignoring possible fraud may prove to be an invitation for perpetrators.

something" campaign, for example, precasters can keep an ear to the ground and pick up on potential threats before they turn into real problems.

Chartier says precasters should also consider their facilities' perimeters and how vulnerable these areas are to potential threats. Physical barriers like fences, waterways and walls can be effective deterrents. When added to the mix, surveillance cameras left on 24/7 and security personnel can help beef up the perimeter and make it much less attractive to criminals. Other good options include authorized truck gates installed at points of egress (such as employee and visitor entrances); exterior doors that are secured and never left propped open; and periodic vehicle inspections (to find stolen goods and equipment).

6. **Effective follow-up and/or investigation.**

Establishing written policies and procedures, and assigning responsibility for implementing them – for follow-up and/or investigation when "red flags" are noted, policy and procedure violations occur, and allegations of improprieties surface – is critical to ensuring that investigation and remediation occurs.

7. **"Zero-tolerance" fraud policy.**

One fraud deterrence strategy is to announce, communicate and enforce a "zero-tolerance" fraud policy, meaning that even the most minor fraudulent activity will be reviewed and prosecuted according to company policies.

8. **Cooperation with prosecution efforts.**

In the event of fraud, execute all required affidavits of forgery, provide requested documentation, make company staff available as witnesses, etc. It is important that a company consistently demonstrate its commitment to a zero-tolerance policy with support for prosecution of any person found to have been engaged in fraudulent activity.

9. **Internal audit/internal investigative units.**

Internal audit and/or internal investigative units are mechanisms for companies to monitor and look for violations of corporate policy and breakdowns in internal control. Companies should evaluate whether to establish these units separately or to combine them.

"Don't make it easy for a contractor to come on site and drive away with a roll of copper wire in his truck," Chartier warns, noting that in many cases the steps taken to shore up a plant can be based on past experiences, area crime statistics (who's doing what to whom) and the issues that other precasters have dealt with. "Look at the types of crime and theft that your firm and others in the area have grappled with in the past," says Chartier, "and begin mapping out your security strategy based on those initial points."

Keeping an "eye" on things

In today's digital age, few would argue the value of 24/7 video surveillance for keeping a precast plant safe from crooks. After all, while it's impossible for owners and managers to be in all places at once, a camera and recording device can serve as their eyes and ears around the clock.

According to Ian Povey, director of product marketing and management at surveillance solutions provider Avigilon (avigilon.com) in Vancouver, British Columbia, precasters should take a multifaceted approach to video surveillance that includes ongoing recordings both inside and outside of the plant, regular reviews of the images to see what's going on when no one is watching, and post-incident reviews to see what happened, who it involved and when it took place.

Today's surveillance systems also allow for easy detection and alerting of boundary crossings or other abnormal behaviors. In some cases, of course, it takes more than a camera to deal with the threats. One rather costly area that companies tend to overlook, for example, are finance- and accounting-related crimes that can take a toll on a precaster's bottom line. "Assess and pinpoint the

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“YOU CAN KEEP REASONABLY HONEST PEOPLE HONEST BY NOT AFFORDING THEM THE OPPORTUNITY TO DO SOMETHING WRONG.”

— Bob Chartier, AlliedBarton security firm

threats first,” Povey advises, “and then develop controls that will help you find anomalies within certain business practices, such as financial systems and ordering systems.”

Precasters who take the time to assess their operations, walk through the potential threats, and then shore up their operations in a way that thwarts crime will benefit from reduced downtime, improved employee safety, better productivity and the peace of mind that comes from knowing that the threats are being kept at bay. Of course, keeping out 100% of the threats isn't always possible. When an incident occurs – and after the proper authorities have been alerted and the necessary insurance and other reports filed – Chartier says precasters should review the situation and any relevant surveillance recordings to help pinpoint the culprit.


The next step will be making sure the problem doesn't happen again. “Review your procedures and policies to determine where and how the breach occurred,” says Chartier. “During that exercise, if you see something within your firm's organizational framework that would be vulnerable to future

threats, you'll want to address it to keep it from recurring. In most cases, avoiding similar problems in the future will require a few tweaks to existing policies.”

As Montalbine found out by talking to area business owners about his firm's repeated theft and vandalism problem, common sense often springs into action when either averting future or dealing with existing criminal activity. In the end, Chartier says the focus should be taking the opportunity away from individuals who have bad intent.

“You can keep reasonably honest people honest by not affording them the opportunity to do something wrong,” remarks Chartier. “You do want to trust and respect your employee pool, and hopefully through your recurring vetting process, that's the caliber of people you have on board. If not, then it's time to come up with measures to keep your assets and employees safe.” ■

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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SOMETHING FROM NOTHING

In 1972, Len Worden had a vision.
Forty-one years later, he and a dedicated team have
far exceeded any expectations he had for the small precast
concrete company he founded.

STORY AND PHOTOS BY KIRK STELSEL



Live free or die. New Hampshire's state motto – part of a one-sentence toast written by Gen. John Stark in 1809 – sticks in your head like a catchy jingle. Stark was speaking to foreign tyranny when he penned those words, but his sentiments still ring true.

His generation formed a country open to ingenuity, hard work and entrepreneurial drive to create something out of nothing. In 1972, Len Worden set out to do exactly that by founding a precast concrete company based on a dry-cast manhole machine he had devised. All he had was an idea, the support of his wife and a drive to succeed.

Today, Concrete Systems Inc. (CSI), located in

Hudson, N.H., has shipped product throughout the United States and Canada, and Len's dry-cast machine can still be found in CSI's manhole plant as well as in 65 to 70 precast plants across the country.

Stark's notion is stamped all over Len's company, his family and the team he credits as the backbone of the company's success.

YOUR REPUTATION

Many precast companies trace their genesis back to septic tanks or burial vaults, but it was manholes that inspired Len's vision and it's what CSI staked its claim on for many years.

Prior to starting CSI, Len moved his family from Canada to Nashua, N.H., to take a position at a

CSI'S ENGINEERED PRODUCTS PLANT IS WHERE THE COMPANY'S WIDE RANGE OF WET-CAST PRODUCTS ARE MANUFACTURED.

MEMORIES AND FRIENDSHIPS ARE THERE FOREVER

Len was very involved with NPCA in the early days, joining immediately after starting CSI. Through the association, he developed strong relationships with people he still considers good friends. The list of Len's friends in the industry reads like a who's who of past presidents and Yoakum Award winners.

"There are guys I think so fondly of – we traveled together, we partied together, we were in each other's plants – and I cherish those memories and that time," he said. "We all had kids, they all had kids and the evolution goes on. It was easier for us to keep in touch back in those days, but those memories and friendships are there forever."



LEN AND MICHELLE WORDEN

In addition to the relationships, Len participated in many efforts to help the industry grow and improve, including serving as NPCA Board Chair in 1994 during which time he helped advance the association as a professionally staffed organization.

"When I was chairman of the board I didn't do any work that the staff could do," he said. "A lot of people are guilty of doing the work. I didn't. I delegated the work – told them what I expected, what I wanted and they were very capable of doing it."

Len has seen the industry change for the best and the evolution of product standards, quality, plant standards and safety as a result of being conscious and doing things the right way.

"I love to look at the pictures and see the plants and see guys I don't even know – I used to know everybody – and everybody seems to be doing an outstanding job," he said.

LEN WORDEN'S DRY-CAST MACHINE IS STILL OPERATIONAL ON CSI'S PLANT FLOOR TODAY.



precast plant, where he learned everything he didn't want to do with his company. So, he set out on his own. Starting with his idea for a dry-cast manhole machine, Len wrote a solid business plan and secured proper financial backing. He wanted to hit the ground running, so he built a new plant and purchased new equipment and a new truck. As far as he was concerned, it was the only way to be a player. Last was hiring the right people. The importance of quality employees to the Worden family cannot be overstated.

With a team he trusted in place, Len used his energy, enthusiasm and understanding of machinery and precast to build a customer base. Chasing jobs was never an option. Rather, he focused on building a solid base of customers, many of whom are still customers today.

"He did it all," said Len's son and company president Mike Worden. "He'd go out and do the sales, come back at night and make manholes to get things going. My father is a smart man, probably the smartest guy I know, but I think the manhole line succeeded because he just out-hustled everybody."

The admiration in Mike's voice when he talks about the work his father put in is obvious, and is trumped only by his respect for his dad's insistence on always backing up what he says he is going to do. Looking back, Len can still remember the first



CSI MANUFACTURES MANHOLES, BARRIER AND OTHER DRY-CAST PRODUCTS AT A HIGH RATE USING LEN WORDEN'S ORIGINAL DRY-CAST MACHINE.

large manhole job he got and how important those intangibles were early on.

"We were scrutinized by a very large contractor who was wondering if we had the capacity to do the job," he said. "I invited him to the factory and I won their confidence that day, and they awarded me the contract. I gave them my word because that's all I had, and they believed in me.

"What else do you have besides your reputation at the end of the day?"

THE "MAIN THING"

Knowing there was demand for more than just manholes, Len began to diversify his product line. However, it was his insight to get into modular buildings for the telecom business that had the biggest impact on the growing company.

CSI began working with telecom giant Motorola and soon found itself shipping buildings as far as Texas, Nevada and even into California. As the product line grew, space at the plant became more and more cramped, so Len acquired a vacant building in Londonderry, N.H., to house the line.


"I think timing the telecom industry and getting into the modular buildings back in the '80s certainly put us into a rapid-growth market," Mike said. "We were in Texas for years at a time in the mid to late 1980s, shipping hundreds of buildings into the state."

Although CSI has phased out that product line, the mark it left on the company is indelible. But as the company saw the market continually declining, the Wordens decided to get out and focus on new ways to use their former modular buildings plant and the valuable floor space it provides.

"You only want to ride (the market) up, you don't want to ride it down," Len said.



Diversification has always been key to the growth of CSI, but one of Len's lessons that Mike took to heart was "keeping the main thing the main thing." At CSI today, six or seven products have become the main thing, but Mike works hard to not lose track of each core product.

CSI has performed a lot of market research and spent a lot of time and energy on product approvals. Today, core products include median barrier, flat-top and skewed



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bridges, box culverts, catch basins, retaining wall systems, sound walls, utility tanks, and stormwater detention/retention products. Many more products simply fall into the "specials" category ranging from special headwalls and rail station platforms to circular precast smokestacks for power plants.

Despite the diversity, the focus for CSI will always come back to the "main thing."

"We don't build everything out there, but we look at it and see if it's something that makes sense to us," Mike said. "You don't want to tie up

all your equipment if you've already got a bunch of other work lined up for it. Sometimes the best project you don't get is the one you say no to."

"You have to have stable product lines to pay the bills and stay in business," Len added. "You can solve any problem in business, I'm talking any problem in business, except for one. And the one you can't solve is if you run out of money and it takes you out of the game."

YOU CAN'T DO IT YOURSELF

It doesn't take long to realize that Len and Mike firmly believe the credit for CSI's success lies with the employees. "It's not us, it's the people," they add. "We were able to build this together. Many of the people who started here have stayed with us and retired in this company or still work here. It's all about the people."

Although neither Len nor Mike can pinpoint why they have been fortunate enough to keep so many long-term employees, both stress the importance of empowering employees to make a lot of strategic decisions. They rely on managers to know what they need on the floor, in the warehouse and in the future, as well as to help put a budget



DAVE COUTOURIER AND MIKE WORDEN WORK CLOSELY TOGETHER, JUST AS THEIR FATHERS DID FOR MANY YEARS.

together and see what's coming down the road.

Mike sees his two main roles in the company as talent scout and opportunity provider. Every employee takes ownership for their actions and the Wordens give them full responsibility.

"Never have we had a culture from the top down," Len said. "There's nothing dictated, and we involve everybody from the grass roots. If I'm at the top, how the hell am I going to know what's going on?"

"You can't do it yourself," Mike adds. It's all about the people. Our employees are our most important asset."

I'M ONE LUCKY GUY

Although Mike is the founder's son and it's easy to think his role at the head of the company was predetermined, reality could not be further from the truth.

Len never set out to build a family business. It was his intention to build a good, solid business for his employees. Although Mike was out helping in the yard as early as 12 years old to earn money for dirt bikes and manufacturing manholes, box culverts, buildings and retaining walls during high school and college summer with his friends, he was never forced into the family business.



His first full-time role in 1989 was right around the time CSI's transportation products were ramping up, so his time was largely spent on the road seeking product approvals throughout the six New England states.

After accomplishing his goal, he returned to the plant and began working under Len's long-

SKEWED BRIDGES ARE AMONG CSI'S CORE PRODUCTS.

	A	B	C	D
1				
2	88% of spreadsheets have errors			
3				
4	How many spreadsheets is your precast company using?			
5				
6				
7				
8				
9				

Source: Ray Panko, a professor of IT management at the University of Hawaii

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CLECO, A PRECISION FABRICATING COMPANY, IS PART OF THE CSI FAMILY OF COMPANIES.

time senior vice president Al Couturier developing new products. As Al neared retirement age, Len's instructions were clear: Spend one year finding somebody to replace yourself and the other year being goodwill ambassador. Len provided Al with a few names of people outside of the company and told him to test the mettle of both internal and external candidates.

"After about a year I said, 'Come on Al, time's up' and Al told me, 'I found a guy,'" Len said.

A DISTINCT ADVANTAGE

When it came to machinery, automation and forming equipment, Len always tried to do it himself. It wasn't long after he got into manufacturing manholes and incorporating Concrete Systems Inc. that he came up with a sister company named Concrete Vibratory Systems Inc. (CVSI).

The company had developed equipment it never planned to sell to other people, but other precasters saw it and wanted to purchase it. Len had one large precaster from the Midwest insistent on purchasing the dry-cast manhole system. It was at that point that Len decided to form CVSI and build dry-cast manhole equipment for retail.

Len still remembers selling the first dry-cast machine. He was just a kid when he flew out to the plant and sat with the owners, but they believed in him and wrote him a check for a third of the cost of the machine before he even started building it.

"I probably broke every speed law on the planet on the way back to the airport," he said.

Len later merged CVSI into Cleco Manufacturing in 1985 after purchasing the company. Cleco, a precision metal fabricator, brought a new set of expertise. The company ships all over the United States and Canada and has even sold its product in Norway.

Today, Cleco performs turnkey plant design, material handling systems, batch plants and more, and allows CSI to be uniquely self-sufficient.

"Certainly, having the machinery side helps us a lot," Mike said. "Being vertically integrated is quite important to us. It's a distinct advantage for us on some of the larger jobs and custom projects."

When Al told him it was Mike, Len's reaction was "Mike who?"

After realizing Al was talking about his son, Len asked what real experience Mike had running a company. Al wisely asked Len how much experience he had running a company when he started, and all Len could say was "good point." Len was pleased with Al's argument, so he called Mike in and told him what was going to happen.

At that moment, he put Mike firmly in control of the company. There were no stepping stones, no interim position and no micromanagement. For Mike, it was a big, and very unexpected, moment.

"I hadn't really given it much thought, because I didn't really know that it was coming," he said. "It's not like my father said, 'Hey, this is what we're thinking.' It actually took me by surprise, because it wasn't anything I had really solicited. I was here just doing my job."

While Al was busy tutoring Len's son, Len was busy tutoring Al's son Dave who had taken an interest in the machinery side of things. Dave is now one of the long-term employees who make CSI tick as the head of its Cleco division.

"My son became Al's protege, and I'd say David became my protege in the machinery and equipment side," Len said. "We both developed each other's sons. Dave is one of the finest people I've ever known, just like his father."

While the move to put Mike in charge was unexpected, and never anything Len had set out to do, Len couldn't be more pleased with how things worked out. "I look at this as I'm one lucky guy that he aspired to the business," he said. "I got a guy I can trust, that's as loyal as can be and his work discipline is the same as mine and his mother's – although his polish comes from his mother. Since that day I talked to him and we made the decision to put him in charge, he's been in charge and I've never had to second guess him or go against anything he's done."

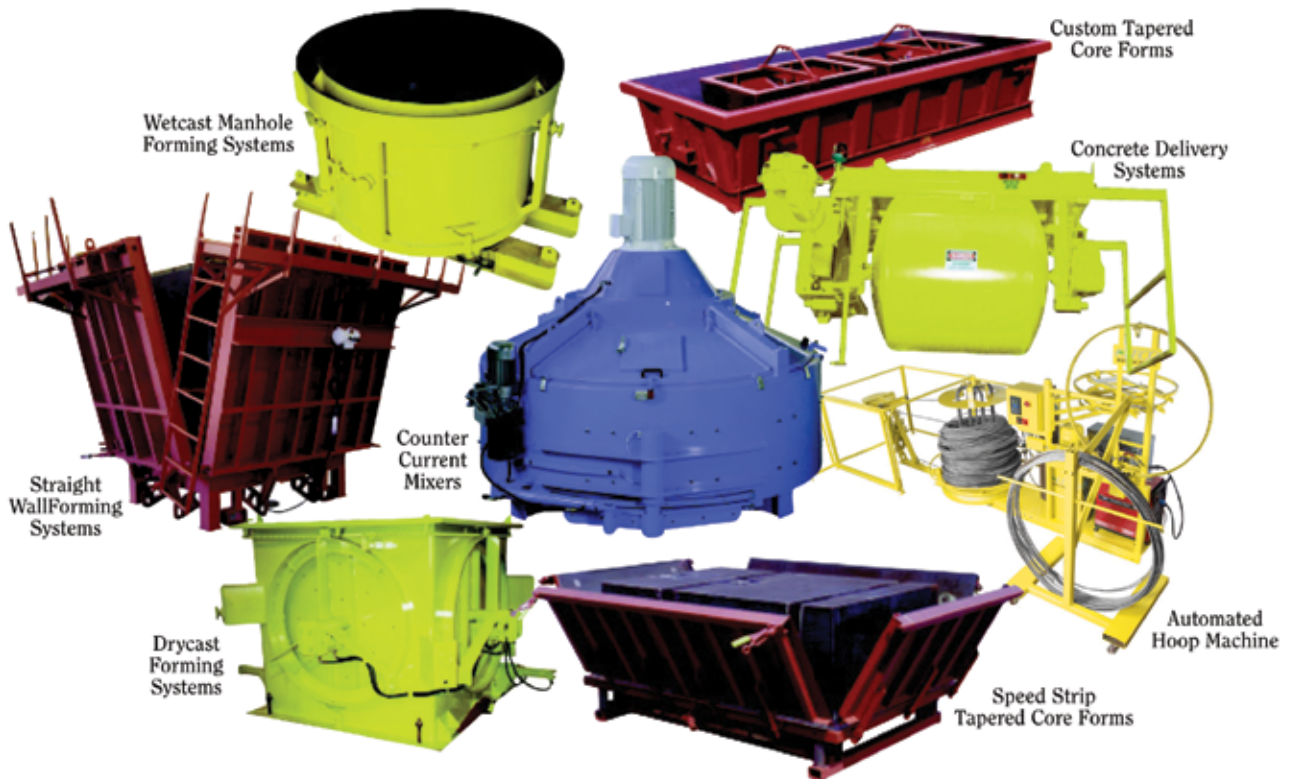
Len also feels fortunate that his oldest daughter, Shelley, has been involved in the business. Shelley came to the company from the corporate world to help it grow in her own way. She implemented new software for more accurate job costing and accounting, and to keep track of all operations. Working with Mike and his team, she also wrote the company's estimating program that is still used today.

"I'm proud to say that Shelley has been here for probably 20 years," Len said. "So you can see how lucky I've been. My family aspired to it."

A REAL GOOD SOLUTION

Licensing has always been a part of the mix at CSI, starting with Stay-Wal and then Neel Company's T-Wall. CSI was also one of the original

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ONE APPLICATION OF CSI'S UWALL IS WING WALLS FOR SHORT-SPAN BRIDGES.

CON/SPAN (now Contech) licensees in 1990 and still manufactures for Contech today. However, the move to being licensor was new territory for the company: CSI jointly developed a retaining wall system it calls Universal Wall, or Uwall, for itself but quickly realized it might be a product other precasters would be interested in manufacturing and decided to establish a licensee network.

"We just think when you have something unique that offers a real viable and economical solution, you may as well allow others a chance to create a good opportunity for themselves," Mike said. "If we didn't feel we had the best product available, we wouldn't bother putting time and energy into getting DOT approvals."

The wall system, a gravity wall to a certain point and then MSE, has now been used for private, commercial and municipal projects, but the main emphasis is highway markets and DOT work. The forms allow the precaster to quickly adapt to different sizes ranging from a 2-ft by 8-ft section up to the largest 7-ft by 8-ft section. The forms also make sloping the face easy, so that the wall can follow the grading on site. Tiebacks are done using a geogrid material made by Italy-based Maccaferri, which have a 122-year design life.

"The top course can become custom sections in essence," Mike said, "but we're set up to do them very economically. To me, it looks more aesthetically pleasing when you have a nice, clean angle all the way down – so it's perfect for large wing walls for bridges too."

The license comes with the engineered wall system, the forms and the forming expertise. Technical training is done on the licensee's

production floor, and they visit CSI for sales and marketing training.

"It's not a solid piece of concrete, but a true engineered wall system with a lot of economies built in. It has a standard 5-in. face, which can easily be adapted to be 12 in. for special applications when needed, and 6-in. standard stems, and the Uwall sections can be installed extremely fast," Mike said.

A LEADING FORCE

There are many more changes on the horizon for CSI, partially because Mike inherited the "never rest" attitude from his father, and partially because of the team and culture the family has built. With engineering, precision form fabrication and decades of manufacturing experience right at its fingertips, the precast company nestled away in Hudson, N.H., will continue to evolve in the years to come.

"We are excited about entering different markets with several additional new products we've been working on, which we'll be ready to roll out in 2014," Mike said. "As we look at our next 40 years," Mike started before Len chipped in "I'll be here!" eliciting a good laugh from his son, "we want to keep CSI positioned as a leading force in our industry. Our slogan is 'New England's Infrastructure Product Source,' and we want to maintain that.

"I'm excited for what the future holds, for all the excellent people we have, and for those who will join us." ■

Kirk Stelsel is NPCA's director of Communication.

Want to see more from our visit to Concrete Systems Inc.? To view additional photos or to read the magazine online, simply visit precast.org/csi, or scan this QR code with your smart phone or tablet.



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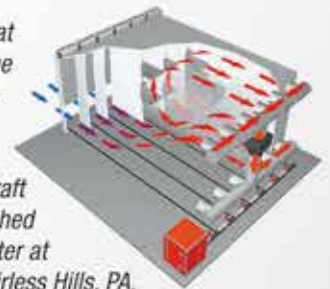


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Buoy Oh Buoy!

THE UNIVERSITY OF NEVADA, RENO ENGINEERING STUDENTS' CONCRETE CANOE COMPETITION TEAM PLACED FIRST IN THE 2013 ASCE MID-PAC CONCRETE CANOE COMPETITION HELD IN SAN JOSE, CALIF. Photo courtesy of University of Nevada, Reno and The Concrete Producer magazine.

BY CLAUDE GOGUEN, P.E., LEED AP

Ever heard of a precast concrete canoe? You probably won't find one at your local sporting goods store, and it's certainly not what Lewis and Clark used on their expedition in 1804. However, reinforced concrete boats were built just a mere 44 years later by Joseph Louis Lambot in Maraval, France, in 1848. Concrete was also used to build barges during World War II to replace scarce steel supplies. And now, each year, the American Society of Civil Engineers holds a competition where teams of university students from around North America build and race their concrete canoes.

Although precast concrete never became the material of choice for boat builders, the fact remains that concrete floats due to the scientific concept known as buoyancy.

Buoyancy is defined as the tendency of a fluid to exert a supporting upward force on a body placed in the fluid. The fluid can be a liquid, as in the case of a boat floating on a lake, or it can be a gas, as in a helium-filled balloon floating in the atmosphere. An elementary application of buoyancy happens whenever you try to push an empty bowl downward into a sink full of water. When applying a downward force to the bowl from your hand, the bowl will stay suspended in place. But as soon as you remove your hand from the bowl, it will float to the surface. The buoyant force on the object determines whether or not the object will sink or float.

Using those same principles, a concrete structure will float if there is not enough downward force to counter the buoyant upward force. An underground structure will eventually lift up out of the ground, causing many problems. And we're not just talking about small 2x2 hand holes – large vaults can be affected as well if conditions are right.

So how do we determine whether an underground concrete structure will resist buoyant forces? Using basic principles, a concrete structure will not float if the sum of the vertical downward forces is greater than the vertical upward force. When applying this principle to a structure below grade, if a buoyant force is greater than the mass of the structure and the combined mass of soil surcharges and objects contained within the structure, the structure will float. This is why buoyancy is an important factor in the design of an underground structure.

Determining water table levels

Typically, contractors who need precast structures will present precasters with details on what they need and give design requirements and information on the underground conditions.

Not always, however, do they inform precasters about every detail, especially job site conditions and problems in the construction area. Site and subsurface conditions are vital pieces of information needed for the design calculations to optimize the performance of the structure in the installed condition and to prevent flotation.

So how does the design engineer determine when there could be a potential problem with the job site conditions and with flotation? First, the design engineer should review and investigate the plans, specifications and soil reports to gain more insight about the project and the underground conditions. One of the first factors that must be determined when analyzing an area in which the concrete structure will be placed below grade is the water table, or groundwater level. Obtaining this information will help the designers identify sites where flotation may or may not be a factor in the design. If no soil reports or

previous water table data are available for fluctuations (seasonal and regional), most engineers will design the structure on the conservative side. This will ensure that the structure will be able to withstand seasonal and regional fluctuations.

Computing downward (gravity) forces

After the water table level has been identified, the design engineer needs to look at computing all the downward forces that will be acting on the structure. All vertical downward forces are caused by gravitational effects, which need to be calculated in the design of an underground structure. At times, these structures will contain fluid, as with septic tanks or grease interceptors. Some will contain equipment, as with utility vaults. The weight of the fluids or equipment in the tank should not be included in the downward force calculation, as the tank may be pumped empty or the equipment removed for maintenance. The following should be considered in calculating the downward force:

- Weight of all walls and slabs
- Weight of soil on slabs
- Weight of soil on shelf or shelves
- Weight of inverts inside structure
- Friction of soil to soil
- Additional concrete added inside structure
- Weight of reinforcing steel

Not all underground structures are the same, and therefore some of the above-listed vertical downward forces may not be included in the summation of total vertical downward force.

Computing upward buoyant force

As stated in Archimedes' Principle, an object is buoyed up by a force equal to the weight of the fluid displaced. For example, if you had a 6-ft-diameter manhole with 7-in. walls, it was 8 ft tall from the bottom of the base to the top of the lid, and the entire structure was designed to be below the water table, you would calculate the total displaced volume of that manhole. You would come up with a volume of around 323

cu ft. Water weighs around 62.4 lbs/cu ft, so the total weight displaced would be a little over 20,000 lbs. That would be your upward buoyant force. If you're using a concrete that weighs 145 lbs/cu ft, that manhole would weight around 19,500 lbs. That means the buoyant force upward is greater than the weight of the manhole, and you're relying on soil friction to keep the structure in place. In this case, the designer may consider using additional measures.

Countermeasures

Several methods can be used to overcome a buoyancy problem:

- 1. Base extension.** Use the additional weight of soil by adding shelves to counteract buoyancy.
- 2. Antiflotation slab.** Anchor the structure to a large concrete mass (shelf) poured on site or use precast concrete manufactured off site.
- 3. Increase member thickness.** Increase the concrete mass (m).
- 4. Lower structure elevation and fill with additional concrete.** Set the precast structure deeper than required for its functional purposes. This will add additional soil weight on top of the structure to oppose buoyant forces. Also, with the structure being deeper in the soil, some contractors opt to pour additional concrete into the base of the installed precast concrete structure.

It is a fairly simple concept: Downward gravitational forces need to exceed upward buoyant forces. In the case of the students in the concrete canoes, they rely on the opposite to stay afloat and bring home the trophy.

NPCA developed a Buoyancy Calculator to help determine if the structure is in danger of floating just by entering dimensions and field conditions. It can be found at precast.org/bcalc. For much more detail, consult the Buoyancy White Paper at precast.org/bpaper. ■

Claude Goguen, P.E., LEED AP, is NPCA's director of Technical Services and Sustainability.

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The Birds and the Bees of Biodiversity

BY CLAUDE GOGUEN, P.E., LEED AP | PHOTOS COURTESY OF WILDLIFE HABITAT COUNCIL (WILDLIFEHC.ORG)

Companies that are taking the first steps toward increasing the sustainability of their operations often look to recycling, decreasing their energy use and reusing some of their process water. These are noble initiatives that help the environment, but there is another dimension to environmental stewardship that can be easy to implement, can save you money, and may be right outside your window: biodiversity.

Most precasters operate in rural areas on large parcels of land used mostly for manufacturing and storage, but there is almost always some unused portion of the property such as grassy areas and wetlands. These areas can be transformed to create, conserve and restore wildlife habitats, and all employees can participate.

Biodiversity projects can vary in scope from large-scale restorations to individual species management and native plantings to suit your preference, and no project is too small. You may be surprised at the number of employees who love gardening, bird watching and other outdoor hobbies. These programs are great for those individuals, and the company can form employee task groups to do the research and get the programs up and running. Biodiversity programs can also include community involvement in habitat projects by collaborating with local teachers and students, scout groups, master gardeners and other community members.

Native landscaping

A great place to start is to decide what you want to do with your property. Are you going to incorporate some native plants to enhance the visual impact of your business? Native plants – also known as indigenous plants – are plants that grow naturally in their particular region, and they exist in “communities” with other native plants. As a result, a community of native plants provides habitat for a variety of native wildlife such as songbirds and butterflies. Areas that have required landscaping and maintenance in the past may now be left to grow and proliferate naturally, reducing time and cost.

Some important facts to remember:

- Native plants do not require fertilizers.
- Native plants require fewer pesticides than lawns.
- Native plants require less water than lawns.
- Native plants provide shelter and food for wildlife.
- Native plants promote biodiversity.
- Native plants save money.

Several organizations provide lists of native plants for a given region, often with information about the conditions the plants require. The most commonly used sources are:

- County master gardeners
- Native plant societies (most counties and states have one)
- Lady Bird Johnson Wildflower Center (wildflower.org)

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- EPA's GreenScapes Program (epa.gov/greenscapes)
- USDA's plant database (plants.usda.gov)
- USDA's Natural Resources Conservation Service (nrcs.usda.gov)
- Wildlife Habitat Council (wildlifehc.org)

There are also state and federal agencies and programs, native plant nurseries and societies you may wish to contact, or software you can use to aid in your research. In addition, many state programs provide technical resources and financial assistance to help you get started.

Pollinator-friendly practices

A pollinator is an animal or insect that fertilizes plants by moving pollen from flower to flower. Only fertilized plants can make fruit and/or seeds, and without them, the plants cannot reproduce. Pollinators include various species of hummingbirds, bees, bats, butterflies, moths and beetles.

Nationwide trends show that pollinating species are declining sharply in number, due largely to improper pesticide use and habitat fragmentation. Pollinator gardens promote pollinator populations by providing food and cover.

Good practices for encouraging pollination are to cultivate

2014 NPCA SUSTAINABILITY AWARDS – WE ARE LOOKING FOR ENTRIES!

We are once again looking for entries for the 2014 NPCA Sustainability Awards. In keeping up with the demands of the construction industry, many NPCA members have adopted sustainable practices in their purchasing, manufacturing and shipping operations. Our industry has benefited from their actions, and it is in this spirit that the Sustainability Committee has created the NPCA Sustainability Awards. The inaugural awards were presented at The Precast Show 2013 in Indianapolis. For a look at the entries and winners, visit precast.org/awards.

The goal of this awards program is to reward excellence in sustainable products, practices and operations by NPCA members, and to publicize the overall progress of the precast concrete industry toward sustainability.

The awards are divided into the following four categories:

PRODUCER MEMBERS

Best Project Entry – Precast product being used in its final design purpose that contributes to the sustainable attributes of the project.

Best Company/Plant Entry – A practice that is performed by the company in doing business specifically at the precast manufacturing plant, showing improvement in sustainable practices.

ASSOCIATE MEMBERS

Best Product Entry – Product being used in its final design purpose in the

manufacturing or performance of a precast concrete product, and that is beneficial to the overall level of sustainability of that intended precast concrete product.

Best Company/Plant Entry – A practice that is performed by the company in doing business specifically at its plant or facility location that shows an improvement in overall sustainable practices.

SUBMITTAL THEMES

The broad scope of sustainability covers environmental, social and economic issues. Examples of topics include, but are not limited to:

- Energy management
- Recycling
- Water-use reduction
- Production-waste reduction
- Substitution of non-renewable materials
- Minimization of packaging
- Vehicle efficiency
- Biodiversity and conservation
- Environmental product declarations
- Employee training programs
- Employee social support programs
- Community liaison
- Support of local organizations
- Supply chain initiatives

Many of these topics are focused on environmental impact. As much as possible, entries should cover the social, economic and environmental benefits of the entry project – although, in many cases, the focus will concentrate on only one aspect of sustainability.

ENTRY GUIDELINES

Any number of entries may be submitted from a company, provided they cover a different or unique aspect of the company or job site.

Entries are limited only to members of the National Precast Concrete Association.

The entry form and details about the award criteria and guidelines can be found on NPCA's website at precast.org/sustainability.

DEADLINE AND SUBMISSION CONTACT DETAILS

The deadline for submittal of an award entry application is Nov. 1, 2013.

All entries must be submitted to:

Sustainability Award Submittals
National Precast Concrete Association
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Carmel, IN 46032

The Sustainability Committee is proud to have this opportunity to recognize those pioneers in our industry that have adopted sustainable practices. By shining the spotlight on these producer and associate members, it is the committee's hope that their initiative and leadership will inspire others to follow and, therefore, contribute to the sustainability of precast concrete products.

For more information, contact Claude Goguen at cgoguen@precast.org or at (800) 366-7731.

native plants (especially those that provide nectar and larval food for pollinators), install houses for bats and native bees, and supply salt or mineral licks for butterflies.

Bird-friendly practices

More than 85% of North American birds nest in the cavities of living trees and standing dead trees. Cavity-nesting birds such as bluebirds, chickadees, nuthatches, wrens, tree swallows and some owl species have experienced significant population declines due to habitat loss from intensive forestry practices and human development.

Artificial nest boxes can enhance the habitats of cavity-nesting birds, and they can be purchased or you can build them yourself. Specifications and plans are available online and can be adapted for various species.



NEST BOXES LIKE THIS ONE BENEFIT CAVITY-NESTING BIRDS SUCH AS CHICKADEES AND NUTHATCHES.

Nest monitoring data can be submitted to Cornell Lab of Ornithology's NestWatch Program (nestwatch.org), an online database that collects information about bird nesting in the United States.

Submitting monitoring data to a larger data repository like NestWatch will strengthen a company's biodiversity programs while participating in citizen science efforts.

Enhancements to ponds and wetlands

Simple structures can be built and submerged or placed on the shore to enhance habitat for aquatic and terrestrial species. They can be as rudimentary as brush piles, rocks and logs to provide areas for breeding, nesting and perching.

Projects involving biodiversity enhancements to plant sites provide many advantages:

- Protects and/or restores wildlife habitats
- Enhances company image and community relations
- Improves employee morale
- Improves rapport with regulatory agencies
- Sometimes results in overall cost savings

Take a moment to consider the implementation of biodiversity-enhancing projects at your plant. It may turn out to be one of the most rewarding things you do for your company, your employees and your community for generations to come.

Contact Claude Goguen at NPCA for guidance on this or any other sustainable initiative at cgoguen@precast.org.

Claude Goguen, P.E., LEED AP, is NPCA's director of Technical Services and Sustainability.



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Plant Certification Program 2014

BY PHILLIP CUTLER, P.E.

What's in store for NPCA Certified Plants in the 11th Edition of the NPCA Quality Control Manual for Precast and Prestressed Concrete Plants?

The NPCA Quality Assurance Committee met during the June Committee Week sessions in Indianapolis. The committee is dedicated to making timely changes and improvements to the requirements in the manual and propelling the NPCA Certification Program forward, and has voted again this year to raise the bar on quality in a number of areas.

The latest changes will include several important updates, but perhaps the most significant is new language under Section 8.2 of the Plant Terms and Conditions concerning the use of the plant certification mark and logo. Major updates to the QC Manual that will be incorporated into the 11th Edition are covered:

- *Chapter 2, Section 2.3.1, "Lifting Devices and Lifting Apparatuses," and Chapter 5, Section 5.1.1. "Raw Material Test Records"* – Under these two sections, additional language will note the new requirement for certified plants to obtain a certificate of compliance from suppliers of embedded lifting devices. The certificate of compliance shall include statements for the type of device and that it meets or exceeds OSHA 29 CFR 1926.704 when compared to the listed catalog rating for the device. The example certificate developed by the NPCA Product Lifting System Task Force can be found on the NPCA website at precast.org/liftcert.
- *Chapter 3, Section 3.2.8, "Ready-Mixed Concrete"* – The committee reviewed the language and requirements of this section and determined that no changes are required at this time. NPCA staff was requested to look further into the

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requirements of this section and report their findings at the next conference call.

Critical Sections

- **Chapter 4, Sections 4.2.1, "Fabrication of Reinforcement"** – The committee reviewed the language and requirements of this section and determined that no modifications are necessary. Certified plants should validate that they have a detailed reinforcing steel plan document in place for each product manufactured at the plant. This detailed plan shall include fabrication tolerances for applicable precast products and/or any project-specific requirements. If no tolerances have been established or references given, then the plant shall specify the tolerance scheme on the reinforcing steel detail plan or in the plant-specific quality control manual.
- **Chapter 4, Section 4.3.3, "Positioning of Reinforcement"** – The committee voted to define "development length" in the commentary section.
- **Chapter 5, Section 5.1.1, "Raw Material Test Records"** – The committee added to the list of required records to include an annual certificate of compliance.
- **Chapter 5, Table a, under Section 5.3.6, "Plant Requirements"** – The Committee reviewed and validated the tables concerning frequency of quality control operations. A certification of compliance for lifting devices under Table 5.3.6a, "Material Certifications and Equipment Calibration," was added as an annual requirement as noted in 2.3.1 and 5.1.1.
- **Chapter 6, Section 6.2.2 Three-Edge Bearing (TEB) Testing** – The committee voted unanimously to align the testing frequency requirements of the TEB tests with the frequencies that are currently in place for the ACPA QCast Plant Certification Program.

Plant Terms and Conditions

- **Section 8.2, "Certification,"** – New subsection 8.2.6 Likely the most significant change in the manual was the addition of language found in a new subsection 8.2.6 of the Plant Terms and Conditions and on all Plant Certification application and contract documents. The new language outlines the consequences and potential penalties for fraudulent use of the NPCA Plant Certification Program mark and logo.

The committee drafted and implemented this language when it was discovered that multiple precast plants were using the mark and logo in a fraudulent manner.

All NPCA members and certified plants are asked to be vigilant regarding these types of violations and notify NPCA immediately of fraudulent use. DOTs and specifying agencies have been made aware of this fraudulent activity and have been provided with information to determine on a real time basis the certification status of any plant that is currently certified under the NPCA Plant Certification Program.

More information can be found at precast.org/certify. ■

Phillip Cutler, P.E., is director of Technical Services and the NPCA Plant Certification Program. The NPCA Plant Certification Program is accredited by the American National Standards Institute (ANSI).

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Martin Clarke awarded OBE

Martin Clarke, chief executive of the British Precast Concrete Federation, has been awarded an OBE (Officer of the Most Excellent Order of the British Empire) in the Queen's birthday honors list for services to industry.

Clarke has spent more than 40 years in the construction industry. He started in the concrete pipe business with ARC Concrete in 1972 where he spent 17

MARTIN CLARKE

years in a variety of marketing and business development roles in the United Kingdom and overseas. He then spent 12 years as marketing director of the British Cement Association before taking over as chief executive of the Leicester-based British Precast Concrete Federation in 2002.

For more information about the British Precast Federation, visit britishprecast.org.



McNutt rejoins Spillman Company

As of June 1, after a seven-year absence, Don McNutt has rejoined Spillman Company, now as president & COO. In his new role with Spillman, he will be responsible for all production, engineering, sales, office and customer activities, and will also directly serve customers in the Southeast United States.

DON McNUTT

During his career, McNutt has been actively involved in various capacities within the concrete products industry. He graduated from the University of Cincinnati with a bachelor's degree in civil engineering and holds P.E. registrations in five states including Ohio. While already a member of ASCE and ASTM, he will become an active member of ASTM C13 on concrete pipe and C27 on precast concrete, and will also participate in various other industry committees.

For more information, contact Ted Coons toll-free at (800) 44-FORMS or (614) 444-2184, or by email at tcoons@spillman-form.com.



Spancrete adds key role of manufacturing engineer

Spancrete, a manufacturer and distributor of prestressed and precast concrete based in Waukesha, Wis., has announced the promotion of John Hanlon to manufacturing engineer. In his new role, Hanlon will work to improve manufacturing processes, standardize and develop precast products, and improve overall production.

JOHN HANLON

For more information about Spancrete, visit spancrete.com.

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BHS expands with U.S. headquarters building

Stuart Bentley, Mixing Division manager of BHS-Sonthofen Inc., has announced the purchase of a 14,000-sq-ft facility in Charlotte, N.C., for the U.S. headquarters of the BHS mixing, filtration and recycling divisions. The expansion combines sales, engineering, lab testing, pilot rental units, spare parts and assembly operations into one location.

BHS serves many industries including ready mix, precast, prestress and mining as well as the chemical, energy, environmental and pharmaceutical marketplaces. For recycling, the size-reduction technologies are used for e-scrap, slag, aluminum and automotive residual shredding.

BHS-Sonthofen Inc. is a wholly owned subsidiary of BHS-Son-



BHS-SONTHOFEN'S NEW HEADQUARTERS FACILITY IN CHARLOTTE, N.C.

thofen GmbH. For more information, visit bhs-sonthofen.com.

C.R. Barger & Sons adds Stone Strong to lineup

Stone Strong Systems has announced that Mickey and Eric Barger, managers of C.R. Barger & Sons Inc. in Lenoir City, Tenn., recently added Stone Strong to the precast business their family has been operating since 1947.

"We're ready to be partnering with Stone Strong and are thrilled to be able to diversify our product offering and provide our customers with an efficient retaining wall solution," explained Eric Barger of C.R. Barger & Sons, Inc.

John Gran, president of Stone Strong Systems, says, "Barger & Sons has been built over five generations, and they are an example of the type of successful

business relationship Stone Strong has established in order to build and maintain a strong network of dealers across North America."

Stone Strong and C.R. Barger & Sons Inc. have already broken ground with a project on the Foothills Parkway in Smokey Mountain National Park.

For more information about C.R. Barger & Sons Inc., visit bargerandsons.com. For more information about Stone Strong Systems, visit stonestrong.com.

Besser introduces online ordering

Online ordering is now available from Besser Co., a supplier of complete manufacturing equipment. Customers can order 24/7 by logging onto connect.besser.com.

Online ordering is a powerful tool for producers who favor the electronic experience. It is easy to use, says the company, and offers several benefits including search by part number and/or description; immediate retrieval of past quotes and sales orders; email confirmations; and secure data storage.

Additionally, the Besser customer service team is available by phone 24/7 at +1-989-354-1000 to support industry members with parts and technical support. ■

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Meeting	Location	Date
NPCA 48th Annual Convention	The Homestead – <i>Hot Springs, Va.</i>	Oct. 9-12, 2013
The Precast Show 2014	George R. Brown Convention Center – <i>Houston</i>	Feb. 13-15, 2014
NPCA 49th Annual Convention	Le Centre Sheraton Montreal – <i>Montreal, Quebec</i>	Oct. 22-25, 2014
The Precast Show 2015	Orange County Convention Center – <i>Orlando, Fla.</i>	March 5-7, 2015
The Precast Show 2016	Nashville Convention Center – <i>Nashville, Tenn.</i>	Jan. 21-23, 2016
The Precast Show 2017	Colorado Convention Center – <i>Denver</i>	Feb. 9-11, 2017

For the most up-to-date information about NPCA events, visit precast.org.

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