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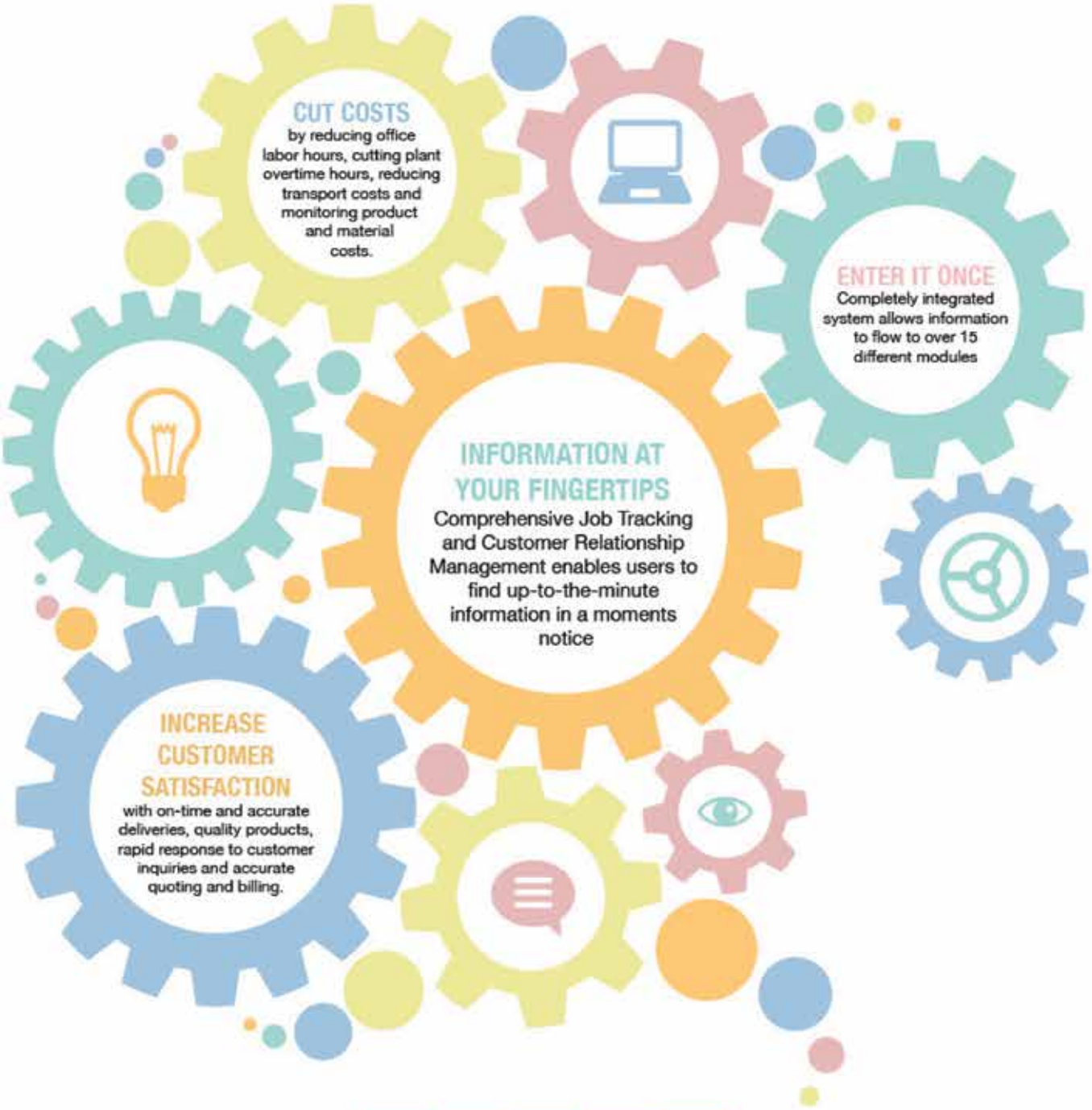

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22 SMaRT Growth

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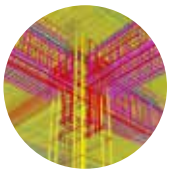

Virtual Reality

Building Information Modeling **(BIM)** in precasting

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On the Cover:

Columbia Precast Products is using sustainability as a key component of its growth plans.

photo courtesy Columbia Precast Products

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Questions from the **Field**

Questions from the Field is a selection of questions **NPCA Technical Services engineers** received from calls, emails and comments on blog posts or magazine articles on precast.org.

If you have a technical question, contact us by calling (800) 366-7731 or visit precast.org/technical-services.

Tom writes:

Most concrete volume changes seem to relate to the time when the concrete is curing. After the concrete is set (let's say for more than one year), will concrete volume increase due to exposure to and absorption of surface water? Or will the volume be relatively fixed and water will just occupy internal porosity within the concrete?

NPCA Technical Services engineers answered:

A significant amount of concrete volume changes will occur in the first 24 hours of placing concrete. Other types of volume change can occur after the concrete has hardened, and may take place for years or even throughout the concrete's service life. Early-age volume changes can affect long-term volume changes.

Concrete that has been designed and manufactured to specific quality standards should have a low porosity and low permeability. When air-entraining admixtures are used, very small air bubbles ranging from about 10 to 1,000 micrometers in diameter are intentionally incorporated into the concrete matrix. When moisture is absorbed into hardened concrete, these evenly distributed microscopic air bubbles provide an area for the water to expand as it freezes, which helps prevent cracking and other issues which can be associated with freeze/thaw cycles.

Entrapped air depends somewhat on certain raw material characteristics and is largely attributed to mixing, placing and poor consolidation practices. The resulting air bubbles are usually 1 millimeter in diameter and larger. When concrete cures, these entrapped air bubbles turn into void spaces, which results in greater porosity, greater permeability, lower strength and lower durability. They could technically provide a space for absorbed water to expand as it freezes; however, the voids are sporadically spaced which makes that behavior unlikely. Entrapped air results in so many detrimental behaviors and characteristics that it shouldn't be rationalized as a means of attempting to manage water expansion.

Drying shrinkage can occur in hardened concrete for years after placement. The amount concrete shrinks, however, is affected by the curing methods when the concrete was first placed. Moist curing methods, higher relative humidity and other favorable curing methods can help reduce the amount of shrinkage.

Temperatures also affect hardened concrete volume. Like most elements, concrete contracts in lower temperatures and expands in higher temperatures. The raw materials used in the concrete have a significant impact on concrete's thermal expansion and contraction potential.

Curling and warping can also occur. These behaviors are most common in slabs on grade rather than precast concrete applications. The degree to which a specimen may curl or warp is highly dependent upon the raw materials and curing procedures used, and can be minimized when appropriate precautions and considerations are taken during material selection, design, placing and curing.

Creep is another potential avenue for hardened concrete volume change. Creep is deformation caused by long-term application of loads. When loads are applied, this deformation begins to take place immediately and continues over time, but at a decreasing rate. The severity of creep depends on the applied load, the age and strength of concrete to which the load is applied, the duration the load is applied to the concrete, as well as the concrete's raw materials and curing conditions. Creep in "younger" concrete is more likely to result in a higher degree of permanent deformation, while creep in more mature concrete is less likely to result in permanent deformation.

Paul writes:

How does your Manhole Sizing Guide correspond to square junction boxes? Is it recommended to leave a 6-inch structural leg between the pipe outside diameter and the interior corner of the box, or does the wall thickness of the box count as the structural leg? For example, would a 36-inch reinforced concrete pipe with a 4-inch wall thickness fit in a 48-inch box, or would it need a 60-inch box to maintain a 6-inch minimum structural leg on each side?

NPCA Technical Services engineers answered:

The short answer is no. The parameters described for circular manholes do not apply to square or rectangular structures. The tricky part with pipe connections for circular manholes is that the opening of these intersecting cylinders isn't really a circle, but a large ellipse. Consequently, to get enough structure between those openings, the manhole structure needs to be much larger than anticipated. Additionally, if resilient rubber connectors are being used, each manufacturer may have additional structural considerations that could lead to manhole diameter upsizing.

The benefit of square or rectangular shapes is that the pipe interface can be flush with the flat wall and consequently a circular opening can be cast or cut to accommodate the pipe outside diameter. This is true for pipes that are straight through or at 90-degree angles. The next consideration is to provide a box section that is structurally adequate to accommodate the potentially large opening.

Regarding the need to have some minimal wall along the pipe entrance surface, the question is whether a structure with a 48-inch inside box width dimension would accommodate a 36-inch pipe with an 8-inch wall. Or, would it require a 60-inch inside width dimension?

The answer is the 48-inch width could be perfectly adequate if it is designed appropriately. There have been many structures that were precast with a base section and two freestanding opposite side walls cast integrally to the base section. The structure is set into the trench with the incoming and outgoing pipes set to grade – typically designed to set on the base section. The minimal void between the pipe's outside diameter and the inside of the box wall is then formed and grouted into place flush to the top of pipe, or in this case also the top of the wall. After appropriate setup and curing time for the grout, the inside plywood forms are removed from the top of structure, mastic rope sealant is applied, and the flattop or casting frame is applied atop the structure.

Again, the key to success is providing a structure that can handle the anticipated loading during installation – which is often the most severe – and after pipe placement, grouting, backfill and possibly live loads. The type of pipe used, whether rigid or flexible, would have an influence on some of the resisting loads of the installed structure. Additionally, when pipe angles are at 90 degrees, the leg of concrete in the corner will behave more as a column than a wall and can be analyzed as such.

The use of square or rectangular structures when designed appropriately can provide the benefit of structure size reduction. However, the use and size availability varies throughout the country. Designers and contractors need to contact their local precast plant to determine what is available for their location. **PI**

Gravity Grease Interceptors:

Lifting the Fog on FOG

Important factors to consider when designing a **precast concrete gravity grease interceptor** system

By Claude Goguen, P.E., LEED AP

NPCA file photo

Is the image of raw sewage spewing from a manhole in front of your house scary? Imagine how it sounds to municipalities and other jurisdictions whose jobs are to keep those sewers functioning. That's one reason why local public health and water officials are always concerned about FOG – fats, oils and greases – entering into the community wastewater system.

If sufficient amounts of FOG enter the sewer pipes, the resulting product will begin to collect on the top and sides of the pipe. Eventually, more grease becomes trapped and the buildup continues. These masses of FOG can grow dramatically based on the size of the pipe and lead to complete blockages, which can then lead to sanitary sewer overflows or SSOs.

For precast concrete producers who manufacture gravity grease interceptors, the burning question is this: Is my tank design optimal for separating FOG? It's important to ask, because the design of a grease interceptor must include many factors that will dictate its efficiency. We're not just talking about a septic tank with longer baffles. This is a different piece of infrastructure with different functions and different design considerations. As a precast concrete producer, you're already using the best material; however, it's also important to ensure you're using the best design.

FOG'S ORIGINS

In order to understand some crucial design principles, we need to learn about the substances we're trying to separate. Let's lift the fog on FOG. According to the Environmental Protection Agency, grease from restaurants, homes and industrial sources is the most common cause of reported blockages in sanitary sewer systems.[1] Restaurants and food service establishments generate FOG every day as they prepare food and clean dishes, utensils and cookware. Residential sewer customers can also contribute significant amounts of FOG to the sewer system.

FOG has evolved over the years as animal fats such as lard have been replaced by vegetable oils, cleaning agents have changed, and hand-washing dishes is now accomplished by dishwashers discharging effluent at a higher

temperature. Each of these factors plays a key role in what type of grease globule enters the interceptor.

GREASE GLOBULES

When grease globules enter a GGI, they will vary in chemistry, size and density and the fluid that surrounds them will vary in chemistry, density and temperature. This disparity will govern whether the grease globule will rise, fall or make its way through the interceptor into our infrastructure. We are trying the avoid the latter situation, so our hope is that globules will rise and stay in the tank, and solids will settle to the bottom.

This is where we look at Stokes's Law. This law, named after British scientist Sir George Stokes, is based on the forces acting on a particle in a fluid. It contains a mathematical equation that expresses the rising or settling velocities of small spherical particles in a fluid medium. Basically, the rising velocity is dependent on the globule's size. Larger globules will rise faster than smaller globules of similar density. Calculations of this vertical velocity can be made based on Stokes's Law.

If the density of the globule is less than the density of the fluid, the globule will rise, and vice versa. For example, a 200-micron-diameter grease globule (.00066 feet) with a density of 54 lbs./ft.^{3} in water with a temperature of 50 degrees Fahrenheit will rise at approximately .24 ft./s. If we were to divide that globule size in half to 100 microns (.00033 feet), the globule would rise at 0.06 ft./s. Therefore, for more effective separation, larger grease globules are optimal. Several factors influence globule size, as outlined below.

Oils used in cooking

The type of oil used can affect the rise velocity of the grease globule based on its density. For example, bacon grease has a density closer to 54 lbs./ft.^{3} (an 8.4-pound difference from water) while zero-trans fat oils are closer to 60 lbs./ft.^{3} (a 2.4-pound difference from water). The closer the grease's density is to that of water, the slower it will rise.

Emulsifying cleaners

Detergents used in today's kitchens may contain emulsifiers to aid in the removal of FOG from dishware and kitchen utensils. Emulsifiers work to prevent FOG from coalescing by reducing the interfacial tension that makes grease globules attract. This process enhances the removal of FOG from utensils and dishware but reduces the size of the grease globules, lessening the ease of separation from the effluent.

Temperature

At higher temperatures, water tends to prevent FOG from coalescing. As such, hotter water may also result in smaller grease globules. Additionally, newer, larger dishwashers can generate a hotter flow. Hot water flow into the grease interceptor containing cooler wastewater can produce a temporary upflow effect due to the lower relative density of the influent stream. However, the short-term impact of this density upflow has a minor effect on the effluent FOG concentration. Over time, the effluent FOG concentration will be similar to previous uniform influent/bulk temperature results.

While grease globules in hot water may be smaller in diameter, the surrounding fluid also has a lower viscosity at higher temperatures. This allows the globules to rise faster. Also, large-volume precast concrete tanks act as a heat sink and are effective in reducing influent water temperature, which allows for the coalescence of smaller globules.

Water conditions

Stokes's Law is only applicable in static water, meaning the environment is calm and without velocity spikes and currents. As a result, it's imperative to maintain a quiescent environment in the tank. According to a study by the Water Environment Research Foundation[2], more effective FOG separation was achieved when fluid velocities near the inlet and outlet were kept below 0.6 in./s.

SIZING OF GREASE INTERCEPTORS

For some, taking the maximum flow rate in gallons per minute and multiplying that figure by 30 minutes is the extent of the gravity grease interceptor sizing exercise.[1]

For example, if you expect no more than 75 gallons per minute to enter the tank, multiply 75 by a 30-minute retention time and the result is 2,250 gallons. This may work in some situations, but information is being left out of this calculation that may lead to a tank too small or too large for the application.

There are some consistent themes when comparing commonly used formulas for sizing grease interceptors. Most of the sizing formulas consider the maximum flow rate into the tank. It's the method of establishing this specific influent flow rate that differs from one formula to another. The most commonly used sizing formulas employed in the U.S. include the U.S. EPA Method; Uniform Plumbing Code, 2003, Appendix H; and Uniform Plumbing Code, 2006 and 2009.

U.S. EPA METHOD

The 1980 version of the EPA formula, which is still used today, calculates the influent flow rate as 5 gallons per meal.

For restaurants, the sizing formula is:

$$GI\ Liquid\ Capacity = D \times GL \times ST \times \frac{HR}{2} \times LF$$

Grease Interceptor Liquid Capacity, U.S. EPA Method.[2]

Where:

D = Number of seats in dining area
GL = Gallons of wastewater per meal, normally 5 gallons
ST = Storage capacity factor – minimum of 1.7, on-site disposal, 2.5
HR = Number of hours open
LF = Loading factor
a) 1.25 – interstate freeways
b) 1.0 – other freeways
c) 1.0 – recreation areas
d) 0.8 – main highways
e) 0.5 – other highways

2003 UNIFORM PLUMBING CODE, APPENDIX H SIZING METHOD

The 2003 Uniform Plumbing Code (UPC) contained a sizing formula in Appendix H. This formula is similar to the EPA formula, where it is based on hydraulic loading and the storage factor.

The formula is:

GI Liquid Capacity
= Meals Per Peak Hour x Waste Flow Rate
x Retention Time x Storage Factor

Grease Interceptor Liquid Capacity, UPC 2003.

Where:

Waste Flow Rate

- With dishwasher – 6-gallon (22.7 L) flow
- Without dishwasher – 5-gallon (18.9 L) flow
- Single-service kitchen – 2-gallon (7.6 L) flow
- Food waste disposer – 1-gallon (3.8 L) flow

Retention Time

Commercial kitchen waste
- Dishwasher – 2.5 hours

Single-service kitchen
- Single Serving – 1.5 hours

Storage Factor

Fully equipped commercial kitchen
- 8 hours of operation: 1
- 16 hours of operation: 2
- 24 hours of operation: 3
- Single-service kitchen: 1.5

2006 AND 2009 UNIFORM PLUMBING CODE METHOD

In 2006, the Uniform Plumbing Code was revised to change the sizing methodology from the Appendix H Method above to a sizing method using drainage fixture units. Dr. Roy Hunger developed DFUs in 1940, which are assigned to individual fixtures based on their potential load-producing effect on the plumbing and wastewater systems. Chapter 7 of the Uniform Plumbing Code contains tables to be used for this sizing method. Chapter 10 of the Uniform Plumbing Code includes Table 1014.3.6 (Table 1), which has recommended grease interceptor volumes based on total DFUs.

One of the issues with using this formula is that while DFU is a common term for plumbers, it is uncommon for pretreatment coordinators and officials dealing with the regulation of GGIs. Also, the DFU does not differentiate between flow from a fixture and flow from a draining sink. When plumbing fixtures do not drain from filled sinks, the faucet flow is used.

DFUs	Interceptor Volume
8	500 gallons
21	750 gallons
35	1,000 gallons
90	1,250 gallons
172	1,500 gallons
216	2,000 gallons
307	2,500 gallons
342	3,000 gallons
428	4,000 gallons
576	5,000 gallons
720	7,500 gallons
2112	10,000 gallons
2640	15,000 gallons

Table 1. Gravity Grease Interceptor Sizing Based on DFUs.[3]

ALTERNATE SIZING METHOD FROM TOWN OF CARY, N.C.

Officials from the town of Cary, N.C., developed a spreadsheet that allows for input of the various fixture types, sizes and characteristics for the calculation of the maximum flow rate into a GGI.[4]

NATIONAL PRECAST CONCRETE ASSOCIATION WHITE PAPER

In 2009, the National Precast Concrete Association published a white paper covering design considerations for precast GGIs.[6] The authors recommended that the 2003 UPC, Appendix H Method for sizing precast GGIs be used when no other code is specified or provided. However, the white paper did not include any data from the WERF studies mentioned above. As such, until further research is conducted, there is no "right" or "wrong" formula to use. Still, taking the maximum flow rate and multiplying by retention time is an ineffective approach, and leaves out many key factors.

In deciding what formula to adopt, the authority having jurisdiction should determine the installed performance of the systems in place and determine if the current design methods employed by code or engineering judgment are appropriate for their jurisdiction. It is important to ensure the formulas used are clear so that the assumptions behind the flow calculations are known.

RESOURCES:

1 Metcalf & Eddy, Burton, F. L., Stensel, H. D., & Tchobanoglous, G. (2003). *Wastewater engineering: treatment and reuse.* McGraw Hill.
2 Otis, R. J., Boyle, W. C., Clements, E. V., & Schmidt, C. J. (1980). *Design Manual; Onsite Wastewater Treatment and Disposal Systems.* Environmental Protection Agency Report EPA-625/1-80-012, October 1980. 412 p, 86 Fig, 82 Tab, 204 Ref. 1 Append.
3 *Uniform Plumbing Code*, 2012
4 http://www.ndwrcdp.org/documents/03-CTS-16T/GISizingSpreadsheetversion.xls
5 https://www.werf.org/a/ka/Search/ResearchProfile.aspx?ReportID=03-CTS-16Tb
6 https://precast.org/wp-content/uploads/2014/08/Grease_Interceptor_Design.pdf

DESIGN OF GRAVITY GREASE INTERCEPTORS

Grease interceptors work to remove FOG and other materials through separation by gravity or flotation. These mechanisms are time-dependent, so the design of the tank must allow for an appropriate amount of retention time and for a calm environment beneath the liquid level.

One important factor that must be regulated is velocity spikes. The tank should be designed to retain the wastewater long enough to allow for separation and must also avoid interaction with previously separated FOG or solids layers.

In addition, the accumulation of FOG and solids layers will, over time, reduce the clear zone. This will result in slightly accelerated velocity of fluid through the tank and reinforces the importance of periodic maintenance and cleaning of the tank. Tank designs should provide easy access that enhances the ability and willingness of owners to clean and maintain the interceptor.

Compartmentalization of GGIs is often used to achieve more separation. Two compartments are common, and three compartments are also sometimes specified. Although it is intuitive to assume that multiple compartments will yield more separation, this is not always the case. The effectiveness of the compartments depends on the connection opening or baffle system.

The Venturi effect, named after Italian physicist Giovanni Battista Venturi, describes how a fluid velocity must increase as it passes through a constriction (Figure 1).

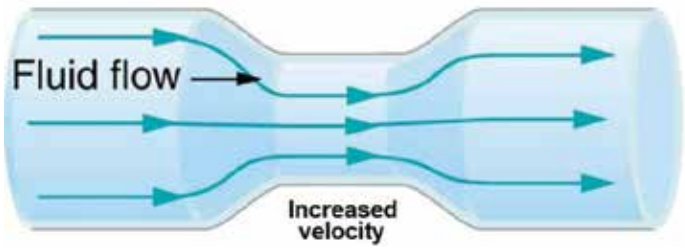


Figure 1. Venturi Effect on a Fluid Through a Constriction

When smaller openings or baffles are used to transfer fluid from one compartment to another, the resulting increased velocity of the fluid can cause the system to short circuit. The WERF study demonstrated that in some cases, single-compartment tanks performed better than dual-compartment tanks for this very reason (Figure 2). Therefore, compartment walls should be designed to distribute the flow and minimize the occurrence of high local fluid velocities. Larger slots or transfer ports are recommended.

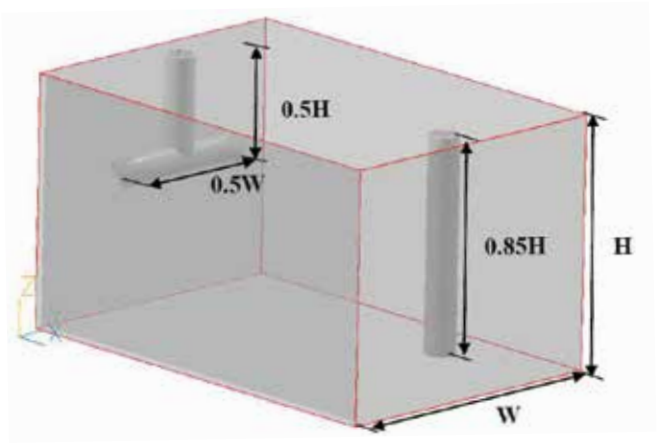


Figure 3. Example of an Influent Baffle System that Could Distribute the Flow Throughout the Grease Interceptor Tank

Figure courtesy of the Water Environment Research Foundation

This comprehensive study also shows that local fluid velocities could be reduced by distributing the flow across a larger cross-sectional area. Ideally, the area would occupy the entire cross-section of the of the grease interceptor (i.e., depth multiplied by height), as this setup would provide the lowest fluid velocities. To achieve this, the influent baffle would have to be designed to distribute the incoming flow (Figure 3).

PRECAST PEACE OF MIND

A properly functioning precast concrete GGI is key to keeping FOG-related issues from occurring in the treatment field or sewer system. The tank's performance will depend on its sizing and design. While flow rate is important in sizing, it is not the only factor that should be considered. Designing the tank to provide ease of maintenance while also maximizing retention time and creating a quiescent environment is essential for effective separation.

Not only do precast concrete GGIs provide the greatest capacity and longest retention times, they also offer the added benefits of structural integrity, design flexibility and a long service life. Outdoor concrete interceptors provide a level of health safety by removing this process from the food preparation environment. They also shift the maintenance responsibility from kitchen staff to third-party maintenance contractors, providing additional quality and safety assurance. As such, precast concrete GGIs are an efficient solution to a critical challenge, offering peace of mind to environmental professionals and facility owners. **PI**

Claude Goguen, P.E., LEED AP, is NPCA's director of technical education and outreach.

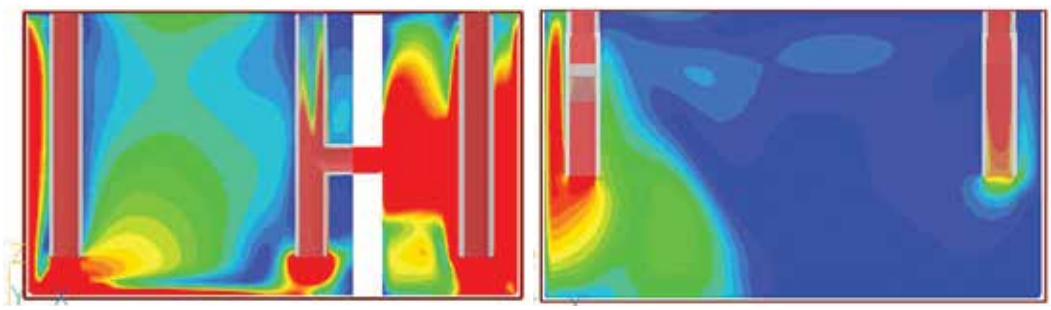
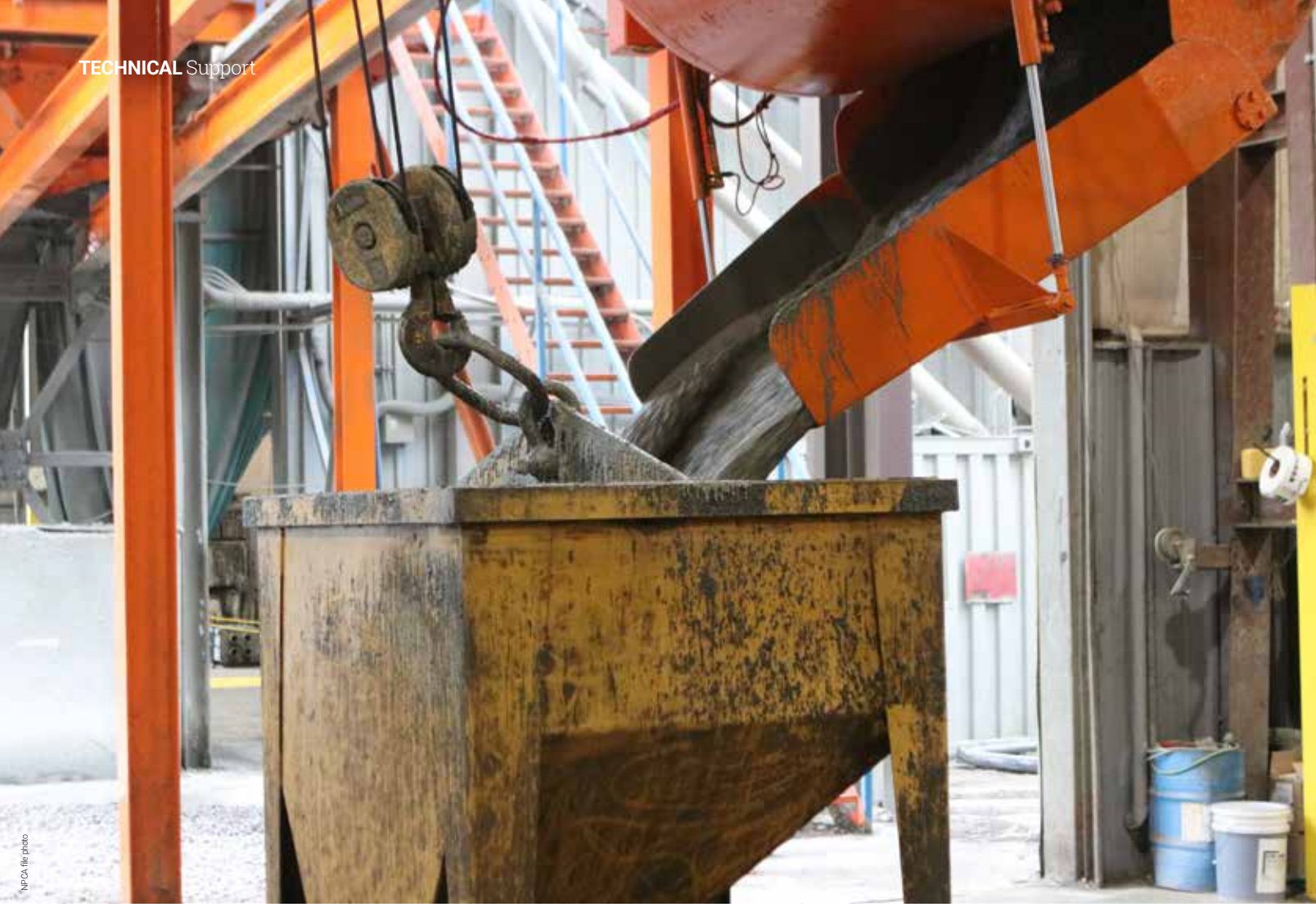


Figure 2. Comparison of Fluid Velocities in Single-Compartment and Two-Compartment Tank When Narrow Transfer Baffle is Used. *Fluid velocity is indicated by color (blue is slow, red is fast).*

Figure courtesy of the Water Environment Research Foundation

RESOURCES:

1 https://www3.epa.gov/npdes/pubs/pretreatment_foodservice_fs.pdf
2 http://www.ndwrcdp.org/documents/03-CTS-16T/03CTS16TAweb.pdf



NPCA file photo

Concrete Mix Design: Understanding Powders

Unraveling the mystery of cementitious materials.

By Paul Ramsburg

Editor's Note: *This is the third article in a year-long series that explores the science of concrete to provide a better understanding of mix design. The series will be collaboratively written by Paul Ramsburg, technical sales specialist at Sika Corp., and Frank Bowen, business development representative with Rosetta Hardscapes.*

Before we discuss cementitious materials, it's important to first recognize that concrete doesn't dry, it cures. The reason is that all portland cements are hydraulic cements, composed of hydraulic calcium silicates and calcium aluminates. As a result, it sets and hardens by a chemical reaction with water – a process called hydration. The mixture of cement and water is referred to as paste. This paste is the adhesive that binds the fine and coarse aggregates together.

HYDRATION: HOW DOES IT OCCUR?

The hydration process starts immediately upon contact between cement and mix water. During hydration, calcium silicates in cement form calcium hydroxide and a gel-like calcium silicate hydrate. CSH gel is the most important cementing component of concrete since it is responsible for setting and hardening and strength development. As hydration proceeds, cement particles and water react to form hydration products in the form of crystals that grow from the cement particles into the space originally occupied by the mix water. As

the particles continue to grow, the crystals converge and the paste solidifies. The concrete gradually stiffens, loses workability, sets and develops mechanical strength.

Once again, concrete does not harden from drying. A cement paste will set and harden even when submerged in water. If sufficient moisture and appropriate temperature are available, hydration will theoretically continue indefinitely, albeit increasingly slow. You've probably heard the Hoover Dam is still curing. I believe this is true, but every time I attempt to core drill a cylinder specimen to prove the theory, I'm chased away.

CEMENT NOMENCLATURE

Before we get too far, let's consider the nomenclature of cements as there are many key terms that are often used but may not always be fully understood.

Clinker

Before becoming cement, the quarried and processed mineral components are known as clinker. Cement clinker is composed of four principal phases that make up about 90% by mass of cement. These phases are:

1. **Tricalcium silicate, C_3S.** Hydrates rapidly and is responsible for setting and early strength development. The rapid hydration of C_3S is accompanied by heat evolution, which may cause concrete's temperature to increase. In general, increasing the C_3S content results in increased early strength.
2. **Dicalcium silicate, C_2S.** Hydrates slower and contributes to later strength development. The slower hydration of C_2S is accompanied by the slower evolution of heat.
3. **Tricalcium aluminate, C_3A**. Reacts very rapidly with water and gives off a large amount of heat. It contributes to setting behavior and early strength gain.
4. **Tetracalcium aluminoferrite, C_4AF.** Reacts like C_3A but much slower, with lower heat development.
5. **Calcium Sulfate (Gypsum), $CaSO_4$**. Calcium sulfate is added during grinding to control C_3A hydration by forming ettringite. Without sulfate, the cement will set very quickly with rapid heat evolution, known as flash set.

Alkalis

Cement is manufactured from natural raw materials and, as such, trace amounts of other substances and materials are present besides the principal mineral phases. The most important of these minor components are the alkalis. Cement's alkali content can affect concrete's setting time, strength development and durability. Alkalis originate from the argillaceous or recycled material components of the cement raw mixture. Alkali content is often noted as equivalent sodium oxide, $Na2O_{eq}$, and is calculated as:

$$\%Na2O_{eq} = \%Na2O+0.658(\%K_2O)$$

Fineness and particle size distribution

The reactivity of cements is directly related to the fineness. Grinding clinker to higher fineness results in smaller cement particles. Smaller particles have a larger surface area where hydration can take place. The fineness of cement can be measured following ASTM C204, "Standard Test Methods for Fineness of Hydraulic Cement by Air-Permeability Apparatus," which gives the cement fineness as surface area of cement particles per unit mass (m^2/kg).

Setting

The initial and final setting time for cement defines its setting characteristics. ASTM C150, "Standard Specification for Portland Cement," has minimum requirements for initial setting time and maximum requirements for final setting time for the different cement types. It also has minimum requirements for compressive strength at given ages between 3 and 28 days for Types I, II and V cements. For Type III, a minimum 1-day strength is also required.

Heat of hydration

Portland cement hydration is an exothermic reaction, meaning it develops heat. The heat given off during curing is called heat of hydration. Increased temperature – whether of the fresh concrete or the ambient temperature – speeds up hydration and decreased temperature slows down hydration.

Fly Ash: 101

Fly ash, the waste by-product of coal-burning power plants, is the most widely used supplementary cementitious material in concrete. There are two types of fly ash, type F and type C. The type of ash is determined by where the coal was originally mined. In general, F ashes come from the eastern U.S., and C ashes come from the western U.S., with the dividing line being roughly the Mississippi River. Fly ash will add to the rheological properties of concrete, making it good for SCC mixes. Fly ash will also heighten the durability of concrete, as will most SCMs. If the loss on ignition varies within a fly ash source, it can contribute to instability in the air void matrix of your concrete.

NPCA file photo

A consideration of the differences between C ash and F ash will be helpful when choosing a material. Class C ash is usually tan or buff in color, making your concrete lighter in color than your straight cement mix design. It may have a high calcium content, meaning you can dose this material higher than F ash, typically at 15% to 35% and sometimes higher. It can have a low loss of ignition naturally, without processing, potentially making the concrete air content more stable than F ash. Though C ash is not as effective as F ash in adding to the concrete's resistance to sulfate attack or alkali silica reactivity.

Class F ash is usually light to dark gray in color, making your concrete somewhat darker in color. It may have a high LOI, meaning that your concrete air content may have a higher variability than you are used to seeing. Processing technology is available to remove carbon, resulting in less air variation. F ash typically increases resistance to sulfate attack and ASR as well as other durability issues.

When you require specific properties of concrete, it is a good idea to do trial batches of the proposed mixes including fly ash. Also, be aware that the specific gravity of ash is lower than portland cement, which is usually about 3.15. This is important when calculating mixture proportions.

CEMENT'S EFFECTS ON CONCRETE

Now that we have the terminology down, we will consider the effects of these cement characteristics on concrete properties, if everything else is equal.

Workability

Cement properties that affect workability the most are those related to the early stages of hydration. Increased cement fineness, increased alkali content and increased C_3A content will increase the cement's reactivity, making the mix less workable as it would cure faster. In addition, changes in sulfate might change set times and, thus, mix workability since calcium sulfates are added to clinker to control reactive C_3A.

Water requirement

Any changes to cement properties (chemical or physical) that increase the air content of a concrete mixture would lower the water demand of that mixture, unless mitigated by other factors.

Slump

Slump loss increases as cement alkali content increases. Increased cement particle fineness will increase slump loss as well.

Rheology

The yield stress value and plastic viscosity of concrete decrease with the fineness of cement. The chemical composition of cement has little effect on the rheological properties of concrete.

Setting time

Increased fineness without an increase in the sulfate content will result in decreased setting times. Increases in C_3A and/or C_3S content will decrease setting times.

Heat of hydration

The rate of heat production and the rate of hydration are closely related. Hence, all characteristics affecting hydration will affect the heat evolution. This includes fineness as well as C_3A and C_3S content. Alkalis also increase the rate of hydration.

Strength

Cements containing large amounts of C_3S may be expected to gain strength quickly, with a more gradual gain in long-term strength. Finer cements also gain strength more quickly.

UNDERSTANDING THE COMPOSITION OF CEMENT

The compounds that make up cement are estimated with Bogue's equations. A closer look at these can help us develop some predictability with our concrete mixes.

Tricalcium Silicate C_3S, or alite, is typically 50% to 63% by mass of any given cement and contributes to both early and late strength development. Cements with higher alkali levels typically have lower C_3S content. The C_3S content can help to predict early strengths based on previous data. For example, if C_3S is higher than normal, and everything else remains the same, then one would expect higher early strengths.

Before we move forward, it's important to note that other contributing factors associated with concrete strength are alkali levels, Blaine fineness and loss of ignition (LOI), as well as the water-cement (w/c) ratio. Cements vary in the way they react, or hydrate, due to differing chemistry. The shape, size, solubility, form, etc., of compounds can differ based on raw materials, rate and length of heating and cooling, and much more. Certain levels of C_3S, alkalis or Blaine fineness don't guarantee good or bad strengths, just different than what you're likely used to.

Dicalcium Silicate C_2S, or belite, is typically 10% to 22% by mass of cement and contributes to late strength development (28 days and beyond).

Tricalcium Aluminate C_3A, or aluminate, is typically 5% to 12% by mass of cement and contributes to very early strength gain (1 to 3 days). It's the first compound to hydrate and will react quickly when in contact with water. This increases the heat of hydration.

Manufacturers incorporate gypsum ($CaSO_4 \cdot 2H_2O$) into cement when they grind the clinker into a fine power at the cement manufacturing facility and use it to control this reaction. When the gypsum comes in contact with water it disassociates ($CaSO_4 \rightarrow CaO + SO_3^{-2}$) and the free sulfate ion reacts with aluminates to form a coating around the compound so that water can't penetrate. The coating breaks down within hours and hydration proceeds. It also impairs the resulting concrete's resistance to sulfate attack. Type II cement, which has moderate sulfate resistance, has a maximum limit of 8% C_3A by mass. Remember, sulfate ions preferentially attack aluminates.

Tetracalcium Aluminoferrite C_4AF, or ferrite, is 5% to 12% by mass of the cement and has little effect on cement's behavior. It is responsible for cement's color by the contribution of ferrite or iron. The higher the C_4AF content, the darker the cement.

Sulfur Trioxide SO_3, or sulfate, is responsible for controlling early hydration of C_3A and is influential in controlling the set time of concrete – primarily through the addition of gypsum. There are two forms of gypsum: Gypsum that is $CaSO_4 \cdot 2H_2O$ (calcium sulfate di-hydrate) and plaster that is $CaSO_4 \cdot ½H_2O$ (calcium sulfate hemi-

How Much Cement

should you use per yard of concrete?

This is a complicated question. The volume of cementitious material needed will depend on your strength requirements and the demands of your other materials. For instance, a very fine sand or small stone will have more surface area to cover with cement paste than coarser aggregate. Aggregate surface texture will also play a role, as was discussed in the previous article in this series. In the first article in this series, we learned that the water-cement ratio plays a key role in early and late strength development. Therefore, typically we select a water content that will be needed for the workability we want to achieve with our mix. Then we determine the water-cement ratio needed for our strength requirement, and that will give us our cement content.

We may know from historic data that we need 26 gallons of water per cubic yard of concrete to achieve our desired concrete flow. We also know that to achieve our early strength requirement, we need to target a 0.42 w/c ratio. Therefore, 26 gallons multiplied by 8.33 pounds per gallon of water (unit weight of water) is roughly 217 pounds of water. Divided by 0.42, that gives us 517 pounds of cement. You may need to add more cementitious material per cubic yard to achieve a higher flow for a self-consolidating concrete mix design. Your material suppliers are a great resource for helping with your specific mix designs.

hydrate). If a cement manufacturer switches between gypsum types, this will alter the set time of concrete using this cement.

MILL CERTIFICATE PROPERTIES

Next, let's explore a few properties of cement that you can find on a mill certification which should be understood and monitored.

You can calculate LOI by finding mass loss when cement is heated to a very high temperature (900 degrees Fahrenheit). LOI is specified in ASTM C150 to have a maximum of 3%. This is an indication of the extent of the hydration and carbonation of free lime and magnesia due to exposure of cement to the atmosphere. If cement or clinker is older and has been exposed to weather, then the LOI will be higher. High LOI will have a detrimental effect on set time, strength and air entrainment. If the LOI changes on a mill certificate, expect these properties to change along with it.

Blaine fineness is the measurement in surface area per unit weight (m^2/kg or cm^2/g) of cement and is an indication of the fineness of a powder. The higher the Blaine, the finer the particles. This relates to reactivity, set time, early strength and final strength. Higher Blaines – as with Type III cements – typically mean faster set times, higher earlier strength, lower long-term strength and stickier fresh concrete. More air entrainment will be necessary to achieve any given air content and more heat is generated early on. Notice that finer cements can result in higher early strengths but also lower 28-day strengths. This is a principle of concrete mix design that should be highlighted, and that transcends just cement fineness. The faster a concrete gains strength, the less strength it will gain overall. Anything we do to speed up strength gain will lower the ultimate strength we would have otherwise achieved.

Another important factor to watch on a mill certification is the -325 Mesh. This is a measurement of the amount of material remaining on a 325 sieve. The coarse particles that are retained on the mesh play a very small role in hydration and strength development, but in conjunction with Blaine fineness, this value can give you a better indication of the particle size distribution of the cement. Cement particle sizes should be evenly distributed. If the Blaine is high (4,800 cm^2/g) and 325 mesh is low (82 percent passing), it means there is a large number of super fines, which is an indication of clinker that has already hydrated. Since this clinker has already reacted, their presence is detrimental to concrete and you could see both early and late strengths decrease even though the cement content and w/c ratio has not changed.

A very important factor to watch on a mill certificate is the total alkalis. This is a weighted average of all the alkalis in a cement. On the certificate you will find it as NaEq, which is equal to $\%Na_2O + .658\ \%K_2O$. The equation assumes that since sodium and potassium are in the same chemical family, they will react the same. Cements that are under .60 Na_2O_{eq} are considered low alkali. Alkalis aid in cement hydration, so higher alkali contents mean higher earlier strengths but slightly lower ultimate strengths. Very fast hydration is detrimental to concrete strength. In addition, a change in alkalis will change how various admixtures perform. For example, higher total alkali content in a cement will require a higher polycarboxylate – a high-range water reducer – dosage to achieve a given self-consolidating concrete, or SCC, slump flow.

APPLYING YOUR KNOWLEDGE

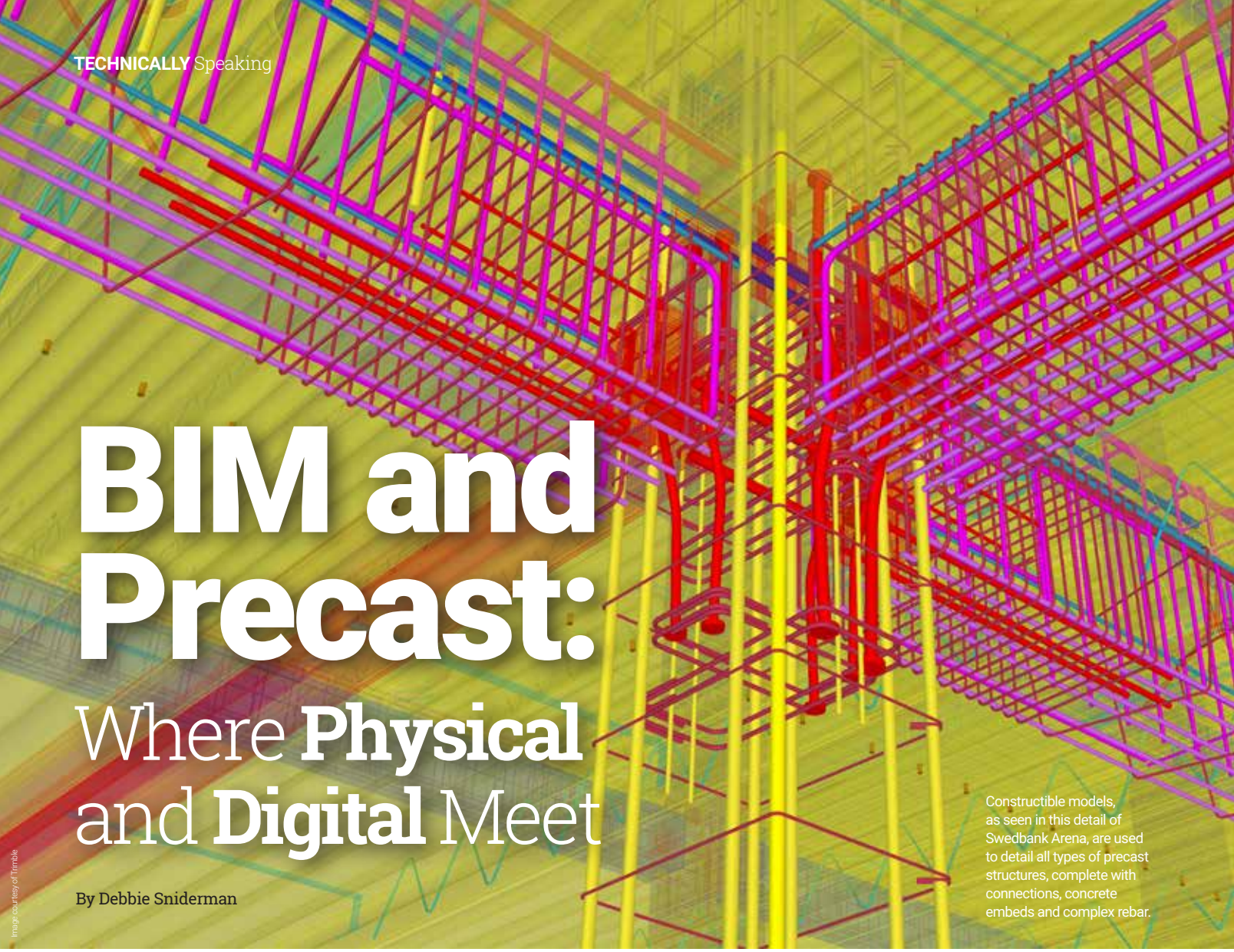
Cement performance is a balancing act of chemical and physical properties. It is important to monitor mill certificates as we receive cement deliveries to our batch plants. Mill certificates are not meaningless papers that we are required to file away. Watch for these attributes that we've discussed here and correlate them to your concrete. Even single-source cement properties can differ at times. Also, keep in mind mill certificates represent about a month's average of tests at the cement mill. An even better indicator, perhaps, of your cement's performance is an ASTM C917, "Standard Test Method for Evaluation of Variability of Cement from a Single Source Based on Strength," report. Be sure to ask your cement supplier for this detailed report.


NPCA file photo

EXPERIMENT AND SEEK HELP

In addition to understanding your cement's properties, we encourage you to experiment with the cement contents and blends of powders within your mix designs in a laboratory environment. Study your mill certificates over time, seek help from your local suppliers and National Precast Concrete Association's materials and courses, and consider using Portland Cement Association's bookstore for study materials. The more you read and get your hands dirty in the lab, the more you'll remove the mystery from cement and, as a result, the performance of your concrete. **PI**

Paul Ramsburg has worked in the prestressed concrete industry since 1988 and is currently a technical sales specialist at Sika Corp



BIM and Precast:

Where **Physical** and **Digital** Meet

By Debbie Sniderman

Image courtesy of Trimble

Constructible models, as seen in this detail of Swedbank Arena, are used to detail all types of precast structures, complete with connections, concrete embeds and complex rebar.

For centuries, designers have relied on two-dimensional physical representations of buildings to translate the ideas in their heads into actionable plans. When the advent of digital computing altered how nearly every profession on earth does its work, Building Information Modeling, more commonly known as BIM, allowed designers to bring those plans into the third dimension for the first time.

BIM software, however, is not only for creating 3-D models at the front end. It creates and stores information and shares it with other data-driven software, making it useful in not only design, but also production planning, manufacturing, quality control, storage, shipment and even tracking issues in the field. For precasters, BIM helps bring 3-D models together in software packages from different sources without the need to go back to 2-D drawings to match things up. It also makes it easy to exchange information with others trades.

DURING DESIGN

Rinaldo Pinchiroli, business development manager for CSG Engineering, says customers are pushing precasters in Italy to optimize production and designs to be competitive and requesting them to provide BIM solutions. Precasters are involved in the design stage, producing models for estimates to quote a job. They receive drawings from architects and clients, study solutions, create layouts and collaborate with multiple sub-trades involved in a project.

"In the estimation stage, BIM helps create preliminary drawings and layouts, including pieces, sizes, beams, columns, panels, and slabs for, say, a building project," Pinchiroli said. "It automatically provides both the volume of concrete and the information about the complexity of the project (e.g. corbels, openings) to estimate the cost of materials and manpower properly."

BIM also helps estimate structural elements, embeds and connections between pieces for the final design that aren't included in the initial model.

"It's faster to create final designs since the software creates connections automatically with structural calculations. It's more precise, so you don't risk missing anything from doing it manually," he said. "The benefits of BIM for precast are different from when the industry changed from the drafting table to AutoCad. With BIM, the productivity benefits are in the design automation, after you've told the computer what rules to apply to automate the design.

"It's a big step in productivity, but it's not easy."

Glen Hutchinson, North American precast account manager at Trimble, maker of Tekla Structures BIM software, said precasters who have taken the initiative to become BIM-enabled have enjoyed a market advantage.

"If precasters are brought on board as early as possible during the planning and design stages, they can cut the total project lifecycle down tremendously by using the BIM model as the single source to drive project data," he said. "They won't have to go back and forth with the typical RFI process."

Tekla Structures models allow detail work inside virtual buildings to identify potential problems early, evaluate alternative structural solutions and ensure constructability.

Photo courtesy of Trimble

POWERFUL BACK-END BENEFITS

Precasters typically use BIM to create final drawings and project models not only for the client, but also for manufacturing. As a result, benefits can include increased productivity, accurate quantity data and error reduction both in the plant during the production phase and on the jobsite during the erection phase.

Using a visual database is much more than a 3-D model used to create drawings. It can export materials, dates and project-driven data to any Enterprise Resource Planning system. Any type of precast product or project can be modeled and tracked through the system to improve internal productivity workflows as well as support external workflows benefitting all the project stakeholders. Status data can include dates, damage status, erection completed or even bidirectional site layout points.

On jobs where every piece is unique, precasters store information about each piece, which can save money during shipping and assists while planning where to store and pour items properly. When working on multiple jobs at once, knowing how to store pieces correctly is critical. BIM makes it easier to compare design and production costs by piece, by job and by line in addition to helping precasters plan both long term and daily.

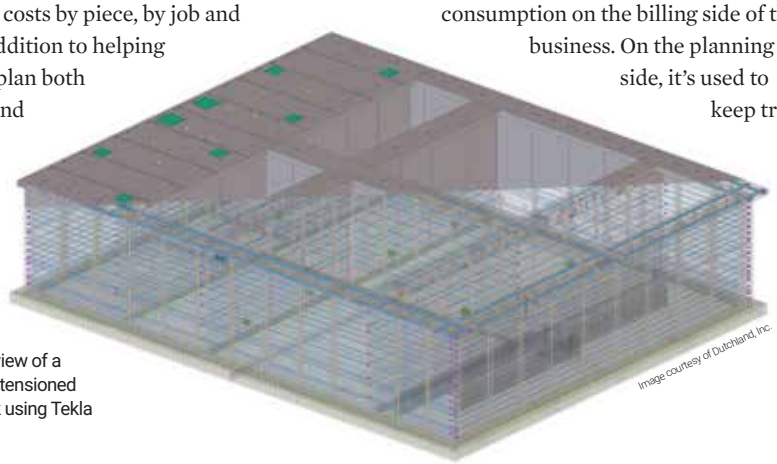


Image courtesy of Dutchland, Inc.

Transparent view of a precast, post-tensioned concrete tank using Tekla Structures.

WELLS CONCRETE EXPERIENCING REAL BENEFITS

Wells Concrete, headquartered in Albany, Minn., uses BIM internally to help produce its products used in places like commercial buildings, schools, stadiums, parking garages and even park restrooms. Jon Feist, director of drafting and outsource management, said when the company models a building, it becomes a huge source of information. Employees include every metal stud and link their Revit model to their accounting, ERP and sales software. It provides everything from preliminary forecast data to actual model data to their purchasing department.

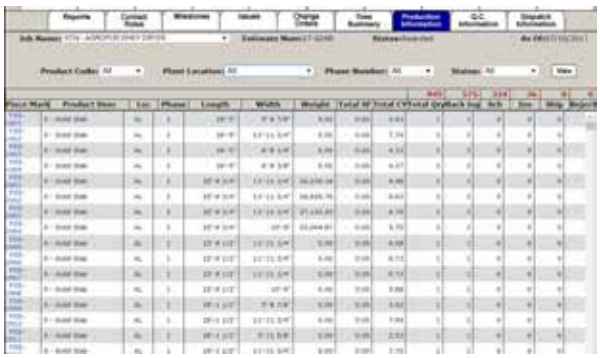


Image courtesy of Wells Precast Concrete

Dashboards at Wells Precast Concrete show data on every member for every production job summarizing basic information fed directly from Revit models.

Wells Concrete uses BIM data for inventory relief and to keep track of consumption on the billing side of the business. On the planning side, it's used to keep track of inventory moving around.

"Everyone in the company uses its data now, whether they know it or not," he said. "Production personnel look at reports with cubic yards of concrete for the day's pour generated from BIM. It ties into our current system and displays real-time data, so we get more up-to-date data and reduce the time people spend doing data input.

"Before, four departments all calculated the weight of every single member we produced manually. Now, no one needs to calculate it, Revit will provide it."

At Wells, they are still discovering ways to use the data to make the company more efficient. With jobs constantly changing, BIM gives information in real time.

TEKLA STRUCTURES AND SOLIDWORKS HELPING DUTCHLAND PRODUCE TANKS

Dutchland Inc. in Gap, Pa., needed a better way to produce the precast tank structures

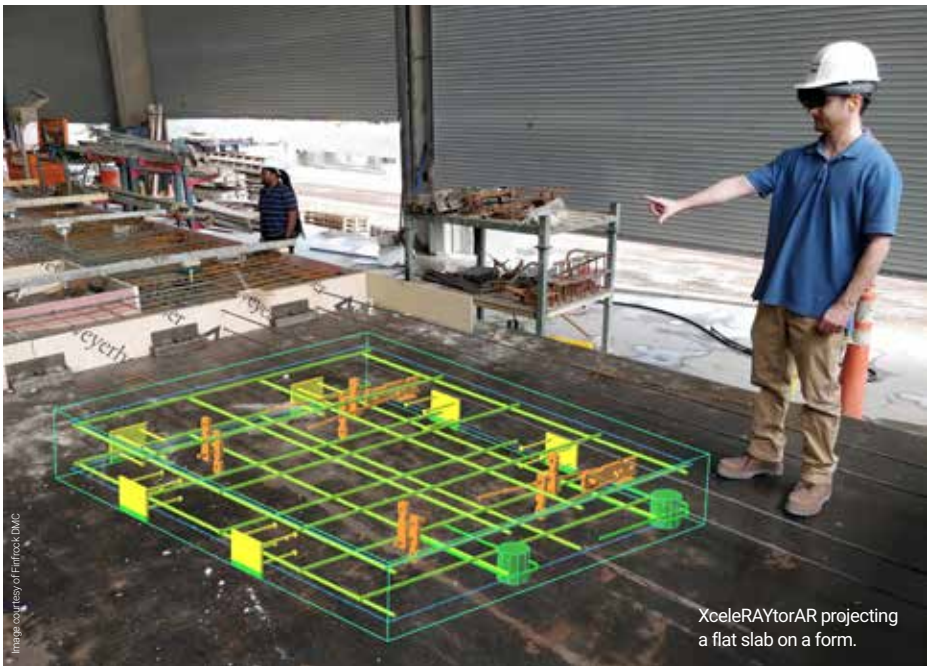


Image courtesy of Fitzfrock DMC

XceleRAYtorAR projecting a flat slab on a form.

it designs, manufacturers and installs for the environmental industry. Its tanks and panels are generally 8.5 feet wide and need to weigh less than 44,000 pounds to ship. Its biggest design challenge is in the post-tensioning. Ducts go from panel-to-panel around circular tanks or corner-to-corner in rectangular tanks and all have to line up in the field.

Chief Engineer Josh Allen said they wanted software to help make sure post-tensioning would line up across panel joints, and to produce more accurate production drawings for people in the plant and erection drawings for field personnel.

"The existing software could handle some parts of what we needed, but not everything," he said. "We had to make workarounds to make the drawings look like what they needed in the field and on the floor."

With its software from Tekla Structures, its designers are able to put all of the reinforcing steel in each piece into the model, something they couldn't do before without bogging down the system. It lets the designers check interferences in 3-D and anticipate them before creating drawings. From the 3-D model, they create production drawings and export cut lists into Excel.

"It will save time creating reinforcing steel cut lists, and offer the ability for field personnel to pull up models on their field computers or tablets, to zoom in to specific project areas as needed," Allen said. "Seeing the panels in 3-D on the shop floor or in the field will be a big help."

Allen suggests preparing for a significant investment in time to learn the software. Dutchland started in July 2017 and is close to completing its 18-month transition to learn, implement, test and train, all while maintaining its current workload.

"We should start doing real jobs using Tekla this May," he said. "We want to use the powerful data extraction features in the software to be worth the investment and not simply use it as a second drafting tool. We see a long-term value in having all of the data in one place where different departments can access it.

"It will improve communication and it will be more real, less dependent on manual takeoffs onto spreadsheets or emails."

TINDALL'S PROGRESS WITH BIM SOLVES BIG CHALLENGES

Mary Ann Griggas-Smith, corporate engineering manager at Tindall Corporation, headquartered in Spartanburg, S.C., said BIM benefits projects with multiple trades on-site. Her engineering group uses 3-D modeling to create production tickets from StructureWorks software. They apply this process to jobs like parking decks where the contractor may not have a BIM requirement.

Before creating models, Tindall's engineering team had to convert 2-D drawings of standard plates and hardware into 3-D widgets. This required establishing drawing formats matching what their in-house shop was accustomed to using. Extensive upfront work was necessary to build custom pieces to fit into the prepackaged software, including writing routines to extract desired data. This learning curve often takes most companies by surprise. From job conception to approval, more time is required with BIM than 2-D drawings without a BIM requirement. But, Griggas-Smith says, the time and money savings are worth it.

The software makes it easier for Tindall to identify potential mistakes when using 3-D instead of evaluating the geometry from 2-D drawings. This is particularly helpful for complex geometries found in projects like stair towers.

"The biggest challenge is coordinating

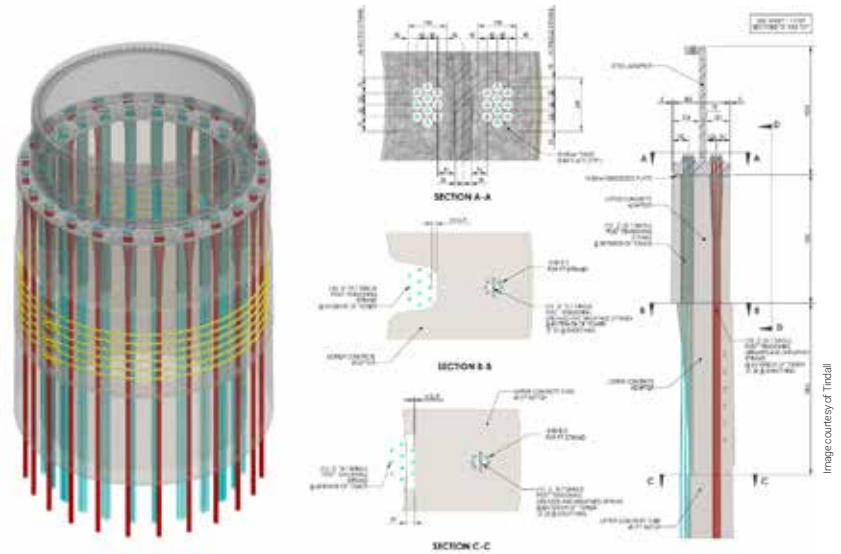


Image courtesy of Tindall

By using BIM, Tindall can share exact item specifications produced by outside steel fabricators and input the data directly into CNC-controlled cutting machines.

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XceleRAYtor laser projection on a form.

Image courtesy of Finfrock DMC

multiple trades at the initial stages of the planning and design process," Griggas-Smith said. "This doesn't always happen. The architect and big-ticket items like steel and precast are brought onboard early, before selecting mechanical and electrical subcontractors.

"Sometimes the contractors don't have a BIM coordinator at the beginning of a project. But, all trades must be unified, and all work needs a common origin. Everyone must export with the same coordinate system so all models work together."

Paperless tickets are the next step at Tindall. The company plans to use model data downstream where the benefits become clear.

"We've gained enough experience with the software and are pleased with the results," Griggas-Smith said. "But, using the data only to create models misses the full value. We are starting to explore process improvements, the natural progression in the industry.

"People who use 3-D software longer tend to do more with it downstream than newer users."

Automatically extracting data from an approved model eliminates manual counting and human error. The system knows what hardware is needed, including what plates and rebar to order. Tindall hopes to integrate directly from the model to tablets to send casting information directly to the bed without paper 2-D drawings.

Griggas-Smith would also like to implement bar codes on every piece in the field.

"Ideally, an engineer or designer would monitor progress and review what has been erected each day," she said. "We would love to arm erectors with tablets in the field. If dimensions are missing, the field personnel could access to the model and retrieve the information.

"Accessing substantial amounts of 3-D BIM data on the cloud can be slow so people are discouraged to use it. Computing power and internet speed at job sites often bottleneck usage."

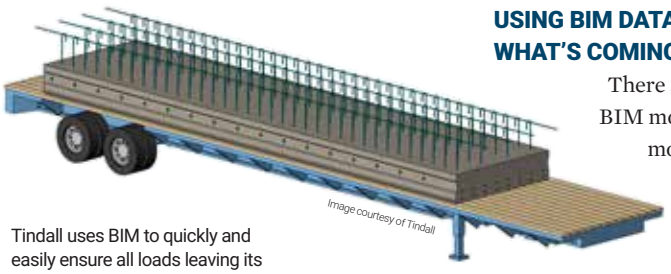


Image courtesy of Tindall

Tindall uses BIM to quickly and easily ensure all loads leaving its facility are safe, stable and conform to DOT regulations.

USING BIM DATA IN THE FUTURE: WHAT'S COMING FOR PRECASTERS

There are new ways to use 3-D BIM model data to save even more time and effort. Wayne Maiuri, vice president of StructureWorks, mentions three of note for precasters.

Laser-assisted manufacturing is one option. Lasers can project features from the model directly onto forms so tape measures aren't needed to set up product embeds or reinforcements, or perform QC processes. This will save time, eliminate paper and decrease errors. The lasers, coupled with the tablet-based, step-by-step 3-D manufacturing documentation, could save 30-70% of measurement time and effort.

In the future, employees could use BIM data with augmented- or mixed-reality devices such as the Microsoft HoloLens, projecting holograms onto the environment around a worker wearing head-mounted sets. The headsets would project everything in 3-D so workers could see rebar, mesh, strand or plates on a form.

QC techs performing inspections could approve and see the items turn green, or disapprove, take pictures of defects, specify a reason and turn the item yellow to review or address later without having to go back to a set of drawings.

"Technicians update screens when they complete their job and anyone can see who did what on any component," Maiuri said. "When there's a problem, it's easier to find the person who touched it, request an engineering confirmation and see an image of a repair to verify defects have been resolved."

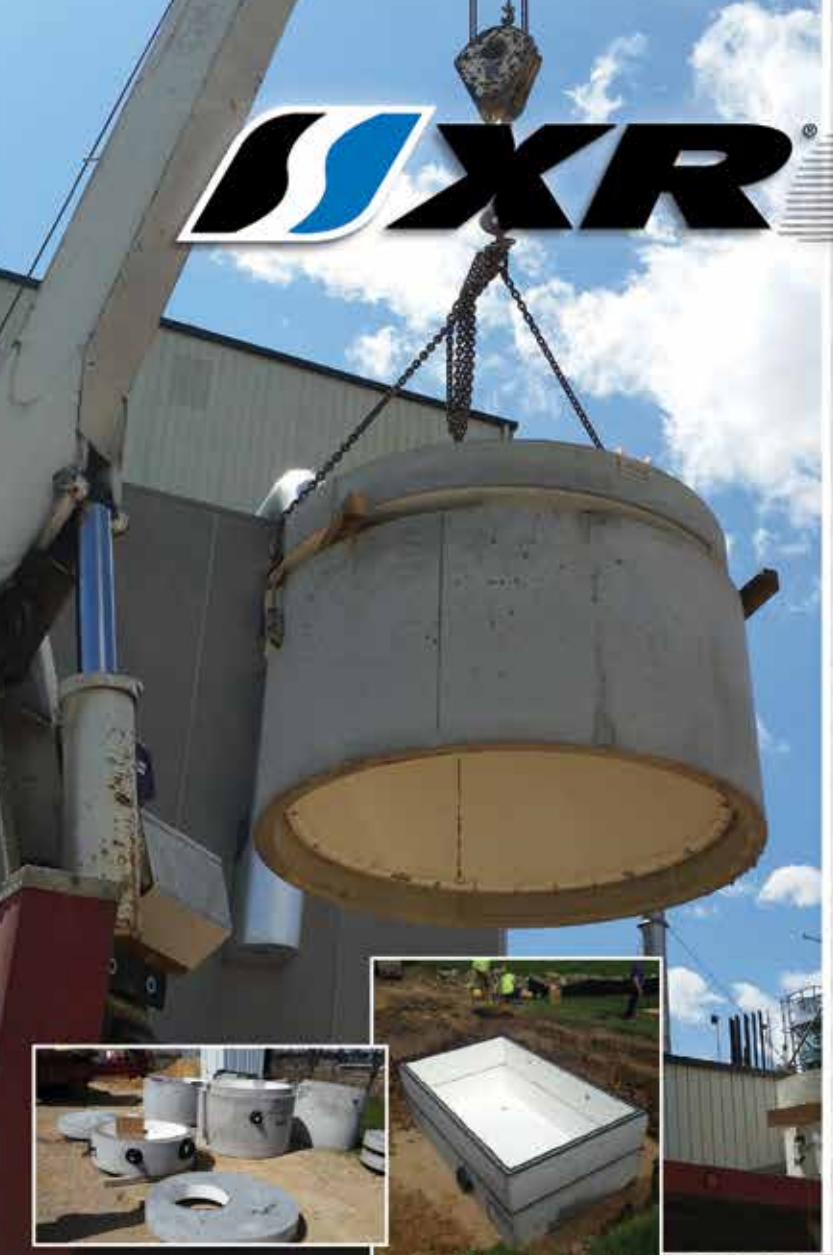
Virtual reality headsets currently use BIM data as a marketing tool for owners to see how things look. In the future, precasters could use virtual reality with BIM data for training or as a collaboration tool in the pre-planning phase along with architects, general contractors and other sub-trades to see collisions in an immersive environment.

BIM TODAY

For now, Griggas-Smith says BIM is still in its infancy in a lot of ways. However, she feels there is a shift occurring in the precast industry as more companies are realizing the benefits of using the software.

"Going from pencil and paper to drawing lines in AutoCad seemed cumbersome at the time," she said. "But when you become more comfortable with a tool, the method becomes much faster. Our group of 20 designers are enthusiastic about the software and improved processes." **PI**

Debbie Sniderman is an engineer and CEO of VI Ventures LLC, an engineering consulting company.



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HOW TO LOSE a Customer in 10+ Easy Ways

By Bob Waterloo

We have all been there. We work our tails off to develop a new account, get the trial order, run the test and finally get the first real order. That, believe it or not, was the easy part. Now, we have to keep the customer coming back! These tips apply to anybody who sells something, whether you are a manufacturer or a supplier in the precast concrete industry or any other industry. Many of these points can also apply to your everyday life with your family and friends.

If you have just won a new account, that means you probably took this business away from a competitor. Do you think your competitor is happy about that? Not likely. But it might be that your competitor has fallen prey to one or more of the 10 easy ways to lose a customer, and now you need to be aware of those same pitfalls.

SO, HOW DO YOU LOSE A CUSTOMER IN 10+ EASY WAYS?

1. Ignore them. You've won their business and now have more important things to do – namely get more business. Unfortunately, your competitor who just lost the account is now thinking of ways to get it back. Large or small, you need to maintain contact with your customers to ensure they are satisfied. Let them know that you are always looking for new ways to help.

2. Make stringent credit policies. "Our terms are net 30 days, and if you can't live with that, go somewhere else." No, we are not our customers' banker, nor should we be responsible for banking their operation. On the other hand, you should know what your competitors are doing, know the industry standards and understand what you can live with. In the construction industry, it's not uncommon for payments from some customers to lag 120 days. Those aren't likely your terms, but if it's a good customer, can you live with that? Your terms can be seen more as a guideline than an ironclad rule. In checking, you will probably find that receivables average about 43 days. Keep in mind that includes those accounts that pay in 30 days or less, along with those that stretch into 120 days. And yes, there is a line drawn in the sand as to how long you allow them to pay.

3. Don't follow-up on requests or questions. A customer calls you and asks for some information. It's not in your area of expertise or responsibility, so you pass it on to the responsible person. A week later, the customer calls again. A week later the customer calls for the third time. If you are passing the baton, confirm it in writing and make sure your co-worker closes the loop with you. Yes, the customer belongs to all of us, but as the salesperson, you're on the front line.

4. Fail to notify them of a change in policy or pricing. Nobody likes price increases, but they are a fact of life in business, and when there is a price hike, it is your responsibility to notify the customer. A phone call puts you on offense rather than defense, and it is a lot easier to be proactive than to defend yourself when a customer is feeling blindsided by a larger-than-expected bill.

5. Micromanage them. You have responsibilities. So do others. When it comes to the important things, be sure to follow-up but don't think you need to cover every little detail. On one hand, it is your responsibility to make sure your customers are always well informed. On the other hand, you don't want to be overbearing.

6. Prejudge them. A customer comes to you, and it's a small operation. You write it off. Then, later, you find that the company expanded the operation or purchased a competitor and is now a player in the market. When you are in the field, it is your responsibility to follow-up on all leads, even if it's just a phone call to qualify the account.

7. Fail to stay in touch. Sometimes a customer is in a remote area or just doesn't fit into your travel plans as frequently as you would like. In that case, call them on the phone and say: "I was just thinking about you and decided to call to see how things are going." That makes the customer feel wanted, which is how you always want your customer to feel.

8. Be sure to point out when they are wrong and you are right. There is more than one way to point out when a customer is wrong. You need to be careful that you don't end up arguing with the customer or play, "I told you so." Present the facts and/or historical data. Being diplomatic is not easy, especially when dealing with a difficult person. Take your time, keep your cool, let things settle down and think about the right approach. Don't show anger. You might win the battle with a direct confrontation, but you will surely lose the war.

9. Don't ensure the question is answered. You provided the requested information, but did you then ask, "does this answer your question?" This follows the concept of the "Johari Window." Read this carefully and think about it: "What I said is not necessarily what you heard, and what I wanted to say is not necessarily what you wanted to hear." Put yourself in your customers' shoes and try to feel as they do when you are dealing with them. 'Nuf said.

10. Stop trying to help your customers improve their business. This applies to the materials you are supplying, but also to other business practices. Your first responsibility is to your own company and products, of course, but if you can share your expertise in other areas to advise a customer, it makes you an invaluable resource rather than just a salesperson.

(I should stop at 10, but …)

11. Stop trying to win business back. The customer moved on, so there's no reason to follow-up again, right? Well, guess what? Things change. And if you're not in regular or semi-regular contact you might just miss a nice opportunity to win a former customer back.

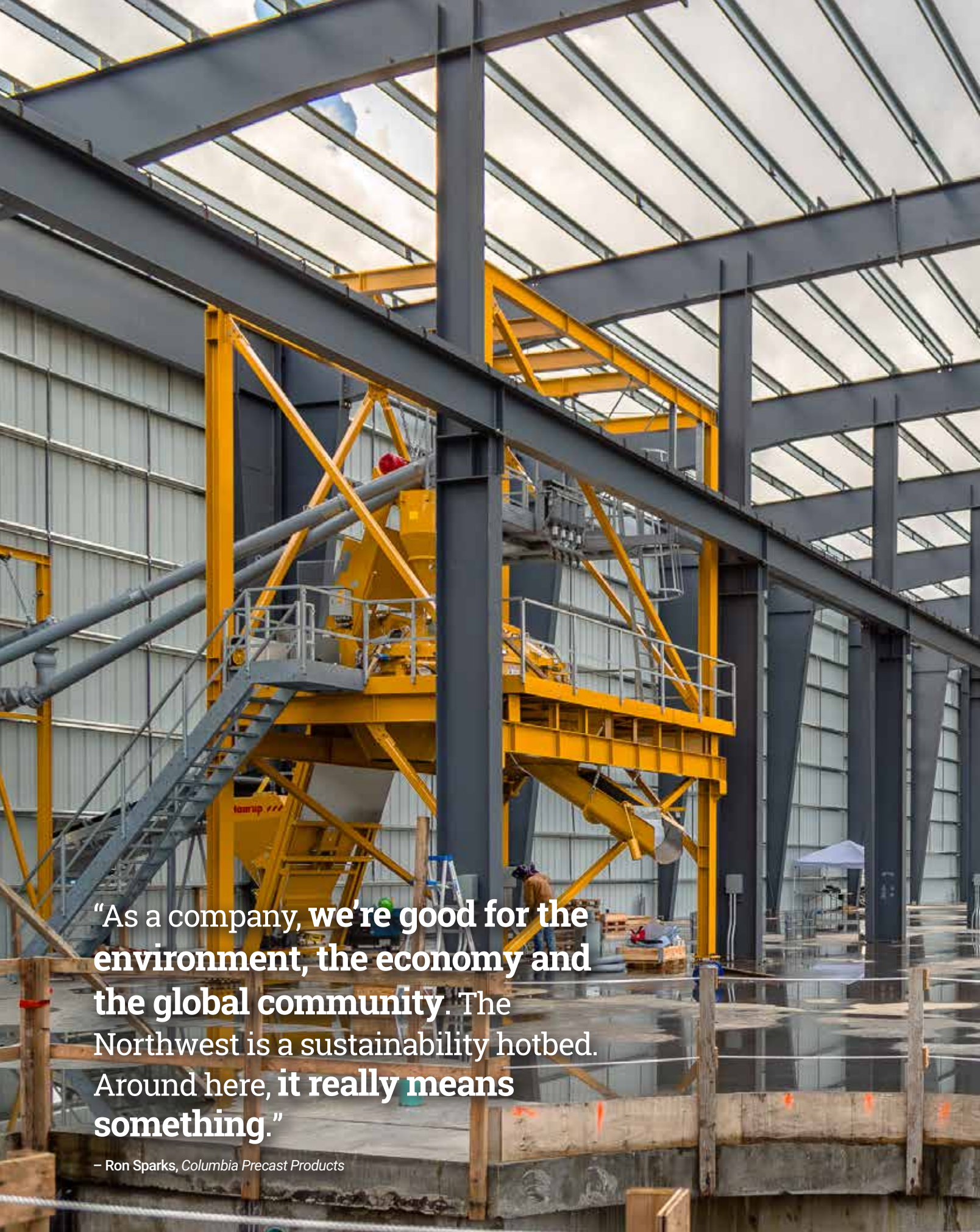
12. Stop asking questions. You can't read the customer's mind, but you can often see things that might prompt you to offer suggestions for improvement. Offer your comments, but don't be obnoxious about it. Sometimes asking questions opens the door for you to share possible improvements.

13. Be a know-it-all. It's never a good idea to let customers know up front that you know more about their operation than they do and that you are smarter. Not a good idea … ever!

14. Be Inflexible. When a customer is looking for a break or wants you to make an exception, your first response might be, "I'd like to help you, but rules are rules and my hands are tied." Instead of just prejudging a request and dismissing it, delve a little deeper. Maybe you can bend the rules, maybe not. But being willing to listen and go to bat for a customer shows you care and your customer will remember that.

There are other ways to lose a customer, but this is a start. It never hurts to review your selling practices and to be responsible to yourself, your company and your customer. In all cases, be sure that you are giving them your full effort. **PI**

Bob Waterloo is a technical sales manager, concrete release agents, for Hill and Griffith Co., based in Indianapolis.



"As a company, **we're good for the environment, the economy and the global community**. The Northwest is a sustainability hotbed. Around here, **it really means something**."

– Ron Sparks, *Columbia Precast Products*

SMaRT GROWTH

COLUMBIA PRECAST PRODUCTS' Sustainable Path to Success

By Bridget McCrea / photos courtesy of Columbia Precast Products

Columbia Precast Products takes environmental sustainability to the next level by becoming the **first** precaster in the U.S. to be awarded the **SMaRT Certification.**

Five years ago, Ron Sparks, a former vice president and general manager for Hanson Pipe & Precast (now Forterra) on the West Coast, picked up on a market shift that led him down the entrepreneurial path. Still feeling the impact of the Great Recession, many precast plants in Washington and Northwest Oregon had either shut down or greatly reduced their capacity. This, in turn, resulted in diminished capacity in the market as a whole and created new opportunities for someone looking to fill in the gaps.

Sparks decided to start his own company and saw the best opportunity in Clark County, which didn't have a precast plant at the time. The company, Columbia Precast Products, opened in Washougal, Wash., with a 10,000 square-foot plant on 3-1/2 acres of land and saw immediate success in the precast-depleted market.

Ron Sparks

Now firmly established and experiencing extraordinary year-over-year sales growth, Sparks is looking to sustainability as the next evolution of the company and a key to maintaining the sharply upward trajectory Columbia Precast Products has experienced since it opened.

THROUGH THE ROOF

To say Sparks, general manager at Columbia Precast Products, was in the right place at the right time would be a major understatement. As the economy began to turn for the better in 2014, Columbia Precast's business "went through the roof," he said. Within one year of opening the doors, the company had outgrown its capacity.

"At the time, it felt almost like a 'once in a career' opportunity to take advantage of what was going on in the marketplace so I went for it," said Sparks.

In 2013, Columbia Precast had six employees and 12 forms. By contracting with a local ready-mix manufacturer,

SMaRT
is the world's standard for sustainable product development and manufacturing.

According to MTS' website, SMaRT signifies a company's bottom-line commitment to being environmentally friendly.

Columbia Precast Products' manufacturing facility was designed with production efficiency, sustainability and future growth in mind.

the firm was able to start producing smaller-diameter drainage products, such as 72-inch and smaller manholes and catch basins. After posting 400% growth during its first year in business, the company began buying additional forms and equipment.

"We started spreading our wings a bit and got into the utility vault business and began making larger-diameter manholes," Sparks said.

By late-2014, Columbia Precast's plant was running at full capacity and was in need of more space. Not able to find ample land in its direct vicinity, the precaster expanded its search criteria and found a 23-acre property situated about 10 miles north of Vancouver, Wash. Deciding that would be his company's new home, Sparks kicked off a building process that would take two years.

"The market was hot during that two-year span, so we spent 2015 and 2016 really capped out at our previous facility," he said.

The manufacturer's capacity crunch eased last April when it moved into its new plant.

"We just hit the ground running as soon as we got here," said Sparks, whose firm has been posting 100% year-over-year sales growth since 2014. "We're expecting another 100% increase in sales for 2018 because we now have more capacity and have been able to push out more product as a result."

Sparks credits the firm's employees, its new production

During construction of Columbia Precast Products' new facility, U.S. Green Building Council's LEED rating system was taken into consideration.

capacity, investments in equipment and the overall market conditions with driving the precaster's consistent triple-digit growth. The fact that so many other precasters either scaled back or shut down during the down economy didn't hurt either.

"Five years ago, about half of the total market capacity in our region was decommissioned," he said. "The plants that were shut down in the Portland metro area were literally handling about 60% of the market capacity. Fast-forward to 2018 and our ability to hire experienced employees, put in machinery and help fill in those gaps as the economy improved have also helped drive company growth."

Along this path has been a focus on sustainability, which Sparks hopes will play a significant role in the company's continued growth pattern.

PRECAST: PRETTY DARNED SUSTAINABLE

Situated in a region where environmental consciousness is highly valued and often seen as a "must have," Columbia Precast places a heavy emphasis on sustainability certifications. This includes both U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) certification and the Institute for Market Transformation to Sustainability's Sustainable Materials Rating Technology, or SMaRT, certification.

Sparks was attending a Pacific Northwest Precast Concrete Association meeting in Portland, Ore., listening to a discussion about the pros and cons of using concrete versus clay pipe, when he heard city engineers tell the audience they were seeking more sustainable materials to build into their infrastructure. One product the engineers mentioned they were considering was SMaRT-certified.

"I'd never heard of that certification before, so I started researching it and learned everything I could about it," said Sparks.

SMaRT is the world's standard for sustainable product development and manufacturing. According to MTS' website, SMaRT signifies a company's bottom-line commitment to being environmentally friendly.

"Once we made the decision to build a new facility, we knew that we wanted to pursue SMaRT certification," Sparks recalled. "It was important to the City of Portland, which is a big client of ours, so it became important for us."

Directly related to LEED, which covers the manufacturing structure itself, SMaRT covers the products that are made in that certified structure. Columbia Precast is currently in the process of getting its facility LEED certified, and the more he learned about SMaRT, the more it became obvious to Sparks that precast was a good match on the merits of sustainability, lifecycle and environmental responsibility.

"We realized precast concrete was a pretty darned sustainable product," said Sparks, adding that the certification process delves into a company's supply chain, vendors and product lifecycle analysis – all of which is handled by a third-party certification firm. "It's a pretty rigorous process. In the end, we became the first precast plant in the U.S. to achieve this certification.

"We are in the category called 'Buried Infrastructure Products.'"

Columbia Precast received the Platinum designation, which is the highest level achievable in the buried pipeline products category. It manufactures its concrete pipe and precast products using completely natural and raw materials that are chemically inert and free of

"Once we made the decision to build a new facility, we knew that we wanted to pursue **SMaRT certification**. It was important to the City of Portland, which is a big client of ours, so **it became important for us.**"

– Ron Sparks, *Columbia Precast Products*

volatile organic compounds. Its products boast the longest lifecycles of any products made for sewer, water, utility and storm drain systems, and the company itself has been certified sustainable to the triple bottom line, an accounting framework that incorporates three dimensions of performance: social, environmental and financial.

"As a company, we're good for the environment, the economy and the global community," said Sparks, who sees Columbia Precast's SMaRT efforts as a true market differentiator. "The Northwest is a sustainability hotbed. Around here, it really means something."

GOING GREEN

Columbia Precast is now seeking to parlay its SMaRT Certification into real business benefits. In January, for example, the company launched an updated website that features the certification. It also held an open house that attracted the attention of a Washington State Department of Transportation representative who specifically referenced SMaRT certification during a 15-minute presentation.

Timothy Buckley AIA, LEED AP, with Greenstone Architecture PLLC in Vancouver, sees SMaRT Certification as a market differentiator and said it will become even more important as a growing number of federal, state and local agencies seek out higher environmental standards for the products and services they're procuring.

"That's just the economic argument for stepping up and improving practices," Buckley said. "On the other side of the coin, there are also economic advantages when organizations identify – through better environmental practices – savings that will be applicable to improving their bottom lines."

For example, for the past 10 years the concrete industry has been looking for ways to reduce the impact of portland cement by replacing a portion of it with supplementary cementitious materials such fly ash and slag. The same mindset can be applied in the manufacturing environment, where reducing energy demand, water usage and waste can all help preserve the earth's natural resources.

"When you can identify those opportunities to make changes to the way you run your business or make your products, it's a win-win for everyone," he said.

For precasters who want to step up their efforts in this area, Buckley said the first step is to evaluate your current operations – such as materials sourcing, plant energy usage and water usage – and then establish metrics and goals based on those existing processes.

Buckley sees SMaRT Certification as one way for precasters to drill down into their current operations and develop ways to work in a more environmentally conscious manner. For example, to attain the certification at any level, products must achieve 14 prerequisite points and score a minimum of 28 out of 162 points in the following areas

covering all product stages across the global supply chain:

- **Safe for public health and environment**
- **Renewable energy and energy reduction**
- **Bio-based or recycled materials**
- **Facility or company requirements**
- **Reclamation sustainable reuse and end-of-life management**
- **Innovation in manufacturing**

"The SMaRT system really looks at that lifecycle analysis, plus all the embodied energy, water and other resources, and the impact on those resources," Buckley said. "For any company that's truly looking to improve in those areas, SMaRT helps identify the big picture opportunities that organizations can target to help reduce their environmental footprints and increase profitability."

WRITING THE NEXT CHAPTER

As he surveys the industrial manufacturing environment in the Pacific Northwest, Sparks sees a lot of companies taking the lean manufacturing route and finding ways to work smarter, better and faster in the current economy. They're paying more attention to detail, he said, and concerned about everything from inventory control to human resources to plant efficiency.

"We experienced a major market shift, and now that we're on the other end of it, everyone is more focused on these factors, plus customer service and product quality, of course," he said.

Focused on hitting another triple-digit sales increase for 2018, and reflecting on his 27 years in the industry, Sparks said the breadth of precast products being made by the industry as a whole continues to proliferate as market conditions and customer preferences change. Within the industry itself, he said precasters are being asked to provide more services, most of which can be traced back to quality and a lack of resources at the customer level.

"Ten years ago, you could hand a catalog cut sheet to a city engineer and it would get approved," Sparks recalled. "Today, we're giving the same engineer a full set of AutoCAD drawings and potentially engineered calculations to support our product, primarily because they don't have the capacity to do that in-house. They're relying on us to do it."

Finally, Sparks sees the retirement of baby boomers and the influx of millennials into the workforce driving another shift in the manufacturing environment, where younger workers have different expectations and ambitions.

"It's a whole different generation with a completely different set of values," Sparks said. "If we want to keep the succession going in the precast industry, we have to embrace that reality and adjust to it." **PI**

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 statewide.

SEPTEMBER 4TH, 9:09 A.M.

A SIMPLE SHIFT IN THINKING ON THE ROAD TO SUCCESS

IN AN INSTANT, EARL NICHOLS LEARNS THE VALUE OF INDUSTRY-LEADING RISK CONTROL

Forty perfect stacks of Jersey barriers stood ready for morning delivery when the new forklift operator lost control of the wheel. Lucky for Earl Nichols of Purdie Concrete, CNA's UL-certified Risk Control engineers had just shown him a new technique to make his stacks more stable and his operation more efficient. So instead of calling his independent agent to file a claim, Earl called his client to confirm delivery and arranged three more shipments for the week ahead. Solid work, Earl!

When it comes to risk control solutions that help NPCA members remain productive and profitable … we can show you more.®

CNA

NPCA

To learn more about our broad portfolio of insurance products and services for precasters, visit www.cna.com/manufacturing.

Workers must take appropriate safety precautions when working on tall forms.

NPCA file photo

BE FORMAL
About Your Form Safety

By Evan Gurley

Formwork. It's an essential component of concrete construction, whether in the field or in a precast plant. Forms come in all shapes, sizes and materials. They can be flat, round, rectangular or octagonal and made from steel, aluminum, wood or rubber.

Regardless of the style or configuration of the form, one thing they all have in common is the potential to injure workers who are not familiar with the characteristics of each form and have not been trained on form safety. Not every form is configured in the same fashion, so the potential hazards presented by each form will vary.

HAZARD IDENTIFICATION AND ASSESSMENT

One of the root causes of workplace injuries, illnesses and incidents is the failure to identify or recognize hazards that are present, or that could have been anticipated. OSHA places the burden on the employer to determine whether hazards are present or are likely to be present.[1]

Form safety would fall under the broad OSHA mandate which states, "the employer shall furnish employment and a place of employment which is free from recognized hazards that cause or are likely to cause death or serious physical harm to employees."

To identify and assess hazards, employers and workers must:

- Collect and review information about the hazards present or likely to be present in the workplace.
- Conduct initial and periodic workplace inspections of the workplace to identify new or recurring hazards.
- Investigate injuries, illnesses, incidents and close calls/near misses to determine the underlying hazards, their causes, and safety and health program shortcomings.
- Group similar incidents and identify trends in injuries, illnesses and hazards reported.
- Consider hazards associated with emergency or non-routine situations.
- Determine the severity and likelihood of incidents that could result from each hazard identified and use this information to prioritize corrective actions.

Fixing hazards on the spot emphasizes the importance of safety and health and takes advantage of a safety leadership opportunity.

FORM HAZARDS

Many potential hazards are inherent to precast forms. Form hazards consist of:

- Walking-working surface hazards
- Mechanical hazards
- Objects falling from forms
- Crushing hazards

These hazards should be known by every employee who works with them. Working with forms is safe as long as those hazards are identified and addressed up front and a safety plan is integrated into daily operations.

FORMS AND FALL PROTECTION

Precast forms may be as small as 18 inches by 18 inches or as big as 15 feet by 30 feet and larger. This means that fall protection when working in and around formwork over 4 feet tall must be addressed.

To prevent workers from being injured from falls related to formwork, precasters and form manufactures have developed safety measures that meet OSHA fall protection requirements.

Catwalks with handrails and self-closing gates prevent accidents when working on taller forms.

NPCA file photo

Walking-Working Surfaces and Fall Protection

Falls from heights and the same level (a working surface) are among the leading causes of serious work-related injuries and deaths. OSHA estimates that about 202,000 serious (lost workday) injuries and 345 fatalities occur annually because of falls. OSHA's final rule on walking-working surfaces and personal fall protection systems protects workers in general industry from these hazards by updating and clarifying standards and adding training and inspection requirements. Most of the rule's provisions took effect in 2017.

The rule requires employers to protect workers from fall hazards along unprotected sides or edges that are at least 4 feet above a lower level. It also sets requirements for fall protection in specific situations, such as hoist areas, areas above dangerous equipment, wall openings, repair pits, stairways and scaffolds. And it establishes requirements for the performance, inspection, use and maintenance of personal fall protection systems.

The final rule made revisions to existing general industry standards. The key changes and new requirements include:

- **Fall protection flexibility (§1910.28(b)).** The final rule allows employers to protect workers from falls by choosing from a range of accepted fall protection systems, including personal fall protection systems. It eliminates the existing mandate to use guardrails as the primary fall protection method and gives employers the flexibility to determine what method they believe will work best in their particular workplace situation. The final rule allows employers to use non-conventional fall protection practices in certain situations.
- **Inspection of walking-working surfaces (§1910.22(d)).** The final rule requires that employers inspect walking-working surfaces regularly and as needed to correct, repair or guard against hazardous conditions.
- **Training (§1910.30).** The final rule requires that employers ensure workers who use personal fall protection and work in other specified high-hazard situations are trained, and retrained as necessary, about fall and equipment hazards, including fall protection systems. Employers must provide information and training to each worker in a manner the worker understands.

Ruben Gallegos, safety manager at Jensen Precast, said catwalks and 42-inch handrails can easily be installed on most forms to keep employees safe. When handrails are not possible, a fall protection harness and lifeline should be used. Blythe Coons, regional sales manager at Spillman Company, said Spillman regularly adds OSHA-style catwalks with handrails, kick plates and self-closing gates.

Another option is precasters can purchase scaffold brackets and scaffolding systems that connect to aluminum formwork when working at heights over 4 feet, said Jim Aylward, precast sales director at Western Forms.

MECHANICAL HAZARDS

Energy sources also pose potential hazards for workers. During the servicing and maintenance of forming equipment, the unexpected startup or release of stored energy can result in serious injury to workers.

The following items address controlling mechanical hazards and hazardous energy:

- Forms should be arranged in such a way that their doors can be fully opened and stairs easily accessed.
- In some situations, the inside of the core can be classified as a confined space. Isolate and lock all sources of energy as required while an employee is performing work inside a core.
- Check hoses and hydraulic components periodically.
- Check spring tension on spring-loaded doors. Check springs, brackets and retainers to ensure they are in good working order.
- Check rolling doors to ensure wheels and tracks stay in place when opened. Make sure they are free of debris and concrete so they will roll easily when pushed.
- Adequately brace, crib or suspend individual form panels that are not stored on the floor or in racks.
- Install and remove bolts using door latches to ensure they can close with little effort.
- Install and remove bolts using the correct wrench or socket.
- Keep all tools free of grease and oil at all times.
- Watch hands when opening and closing hinged cores.
- Watch hands and arms when opening and closing outer walls/jackets.
- Do not walk on top of a pallet or shiplap resting inside the form. Reach around it.
- Install as many components as possible while the rebar cages are on the floor.

Failure to control hazardous energy accounts for nearly 10 percent of the serious accidents in many industries.[2] Proper practices and procedures safeguard workers from hazardous energy releases and mechanical hazards.

FORM MAINTENANCE PROGRAM

Developing a form maintenance program is one of the ways to ensure that safety and quality is achieved. Not only is this an industry best practice, but it is a requirement for NPCA certified plants.

Section 4.1.3 in the NPCA Quality Control Manual for Precast Concrete Plants states, "Forms and forming equipment for manufacturing precast products shall be of a quality that prevents

Insight from Industry Q & A

Form manufacturers and precasters were asked several questions related to form maintenance and form safety. Below are the questions and answers from the responders.

What steps should precasters be taking to keep their formwork in good working condition?

"At Jensen, we implement a preventive maintenance program where forms are inspected at least monthly and deficiencies corrected promptly."
– Ruben Gallegos, Jensen Precast

"Keep forms clean, since build up can change the center of gravity on pieces and parts. Keep forms oiled for easier stripping."
–Blythe Coons, Spillman Company

"Using a quality form release and cleaning forms with every use will keep the face of the forms clean for many years. The other best practice to increase the life of your equipment is to avoid hammering on them as much as possible – abstinence is the best policy here!"
– Jim Aylward, Western Forms

"Have a daily checklist inspection for your lead man. When something breaks, fix it. Don't try to get by with the form because it is needed."
– Mike Vergona, Garden State Precast

What are some safety precautions precasters should keep in mind when working with and around forms?

"Wearing the proper safety items is an essential first step (safety glasses, hearing protection, steel-toed boots). Always be aware of your surroundings. Never over-tighten wedges for formwork that require a pin and wedge to connect."
– Jim Aylward, Western Forms

"Make sure you have at least 42 to 48 inches between forms. When opening doors on forms, be sure guys are standing to the side. Be sure the work area is clean and there is proper lighting.
– Mike Vergona, Garden State Precast

"Drop-down shell walls pose a very serious threat for injury should they ever uncontrollably fall. Use a buddy system to ensure that only shell walls hooked to the crane will have the bolts removed. Keep all other employees out of the immediate work area."
– Ruben Gallegos, Jensen Precast

"Be aware of pinch points and avoid climbing on forms without an OSHA walkway."
–Blythe Coons, Spillman Company

What are some safety features that you can incorporate into formwork?

"Safety pins at the hinges and safety chains on the upper corners to keep shell walls from falling must always be used. Have workers stand at the corner so that in case of an accidental drop the employee is not hurt."
– Ruben Gallegos, Jensen Precast

"For aluminum forms, Western Forms invented the Pinlock-attached hardware and Gaskets for the siderails. The Pinlock is mounted to the form to reduce the loose pieces in the plant, and it also prevents wedges from vibrating out of the forms. The Gasket siderails make the forms easier to set and strip because concrete is not binding the forms together. This eliminates the 'need' to hammer on the sides or yank on the forms to strip."
– Jim Aylward, Western Forms

"Light poles are the biggest safety concern for us. If a light pole is higher than 10 feet, we cut a hole in the form and pour it on its side. Also, when stripping light poles, we make legs for each half so when you pull apart the pole, you open the legs and the form will not fall over. All light poles are also hooked up to a crane before the jackets are taken off, so there is no chance of it falling over."
– Mike Vergona, Garden State Precast

"We can incorporate locking features, OSHA-style catwalks with handrails, kick plates and self-closing gates."
–Blythe Coons, Spillman Company

How does the new OSHA walking and working surfaces regulation affect formwork precasters use?

"Keep catwalks in good repair, without holes or protrusions. Promptly repair handrails that get bent. Implement an effective housekeeping program to minimize slips, trips and fall hazards."
– Ruben Gallegos, Jensen Precast

"I think it is a good thing. Guys no longer have extension cords going across catwalks and scaffolding. Also, now guys aren't putting too much weight on scaffolding and the clean area makes them less likely to get hurt."
– Mike Vergona, Garden State Precast

"Using our scaffold bracket for a walking and working surface gives you the ability to utilize whatever walk-plank you desire to meet OSHA requirements as well as employee preference."
– Jim Aylward, Western Forms

"Hopefully, it will encourage precasters to opt for the optional OSHA-style catwalks and walkways."
–Blythe Coons, Spillman Company

Insight from Industry Q & A (cont.)

What should precasters avoid when working on forms?

"Employees should not be climbing on top of the core of the form without fall protection. Employees should not climb on the rebar cage to access higher elevation."
– Ruben Gallegos, Jensen Precast

"Employees should not be climbing on the form instead of using a ladder and not be standing on forms greater than 4 feet without proper fall protection. They should also be standing far enough away when stripping the piece."
– Mike Vergona, Garden State Precast

"I see precasters using pry bars at the top of forms to strip them off a product. This practice can chip the concrete and damage the forms over time."
– Jim Aylward, Western Forms

"When oiling, precasters need to understand that they can create slip/trip hazards. We see people climbing all over forms without proper personal fall protection or OSHA-approved walkways."
–Blythe Coons, Spillman Company

Any tips or best practices you would like to share with precasters to help increase the lifespan of their formwork and to ensure safety?

"Plants should have a schedule for weekly, monthly and annual form maintenance. If a form is not level, it practically won't even strip, so it's the first thing that needs to happen, and it is the No. 1 thing that we ask when a form isn't performing properly."
–Blythe Coons, Spillman Company

"Biggest tips on increasing the life of aluminum formwork:
1. Invest in quality.
2. Use quality form release (reactive release designed for aluminum forms) to keep the forms clean.
3. Train employees to treat the equipment with care.
4. Use proper tools associated with the formwork.
5. Reach out to manufacturers for questions and concerns."
– Jim Aylward, Western Forms

"All employees performing work around forms and catwalks must clean up after themselves immediately. All catwalks must be kept clean and uncluttered, free of debris such as rebar, terminators and concrete build up to prevent slips, trips and falls. Remove all tripping hazards."
– Ruben Gallegos, Jensen Precast

"Don't try to save money on form oil. Figure out what works best for you and keep it. Don't allow employees to use hammers to clean forms. Grease all grease fittings regularly. Take time to clean the inside of the forms."
– Mike Vergona, Garden State Precast

product damage due to forces and vibrations subjected to the forms. All forms and forming equipment (including pallets, headers, truing rings) shall be measured prior to initial use and not less than annually for dimensional conformance with applicable tolerances."

The manual goes on to state, "Forms shall be carefully cleaned of concrete build-up after each use. Coatings of form release agents shall not be allowed to build up."

Adequate spacing between forms to prevent pinch points is critical.

NPCA file photo

In addition, the manual states, "Forms for manufacturing precast concrete products shall be of the type and design consistent with industry standards and practices. They should be capable of consistently providing uniform products and dimensions. Forms shall be constructed so that the forces and vibrations to which the forms will be subjected can cause no product damage."

There's much to consider when it comes to proper upkeep and maintenance of concrete forms. Developing and following a form maintenance program will ensure the longevity of formwork project after project.

SAFETY FIRST

Form hazards are real and should be addressed when performing a hazard assessment of the plant, yard and form storage areas. Each type of form presents a unique safety challenge. Be sure your employees understand all of your forms. No matter what type of form you're using, follow the basic safety and maintenance guidelines to keep workers safe and enhance the quality of your products. **PI**

Evan Gurley is a technical services engineer with NPCA.

RESOURCE:

1 OSHA [29 CFR 1915.152(b)].
2 https://www.osha.gov/SLTC/controlhazardousenergy/

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NORTHEAST PRECAST CONCRETE ASSOCIATION

NPCA 53rd Annual Convention

Working For You

NPCA Professional Staff Members Attend ACI Spring Convention

By Kirk Stelsel

Eric Carleton, P.E.

Claude Goguen, P.E., LEED AP

Serving as a point of outreach for specifiers and participating in national-level codes and standards meetings is one of the top priorities for the National Precast Concrete Association professional staff. To further this effort, NPCA professional staff members attended the ACI Spring Convention held March 25-29, 2018, to participate in several committee meetings, sit in on information sessions and network with other professionals in the industry.

Eric Carleton, P.E., director of codes and standards, is a newly appointed member of ACI 301, Specifications for Structural Concrete, subcommittees 301M Precast Structural Concrete and 301N Precast Architectural Concrete. This committee is developing the new code modifications for the 2020 Concrete Specification Code. He also attended many sessions, including accelerated bridge construction, fiber-reinforced concrete design criteria, and a presentation from Oregon State University researchers on their study on Microbial Induced Corrosion, commonly known as MIC.

Claude Goguen, P.E., LEED AP, director of sustainability and technical education, serves on committee ACI E702, Designing Concrete Structures, which helps develop educational programs and materials within the area of structural concrete design. One of the goals of the committee is to have education sessions at each convention, and he is working on one for Spring 2019 on the topic of precast concrete parking structures. Goguen also serves on ACI 130, Sustainability of Concrete.

He attended many sessions, including controlling the fresh properties of self-consolidating concrete for adequate placement that included six presenters demonstrating new techniques. The session focused on transporting the concrete without altering the desired properties of the mix, as well as admixtures that can be activated to provide early stiffening. Goguen also attended the ACI 201, Durability of Concrete, committee meeting. Of special interest is the formation of a task group to address microbial induced corrosion. The committee plans to develop language regarding this phenomenon and education sessions at upcoming conventions.

Goguen was also able to speak with some Concrete Industry Management students and faculty from California State University – Chico. The NPCA Foundation has been assisting Dr. Mohammed Albahttiti with precast concrete content for the program at Chico. He also spoke with Dr. Jason Weiss from Oregon State to discuss progress on the C13.03 MIC Project.

"There is so much great information shared in committee meetings and educational sessions," Goguen said. "Not all of it relates to precast concrete, but some of it may make its way to the industry or pose a threat to our industry. Regardless, it's paramount to stay informed on the latest advances and changes, and that's why it's so valuable to NPCA professional staff and NPCA members." **PI**

OTHER SESSIONS AND COMMITTEE MEETINGS NPCA ENGINEERS ATTENDED INCLUDED:

- Advances in concrete bridges
- Advances in internal curing
- Chemical admixture compatibility
- Fiber-reinforced concrete
- How to detect if a bridge needs replacement or repair
- Thermal detection of subsurface delaminations in reinforced concrete bridge decks using unmanned aerial vehicles
- Ultra-high performance concrete
- Using slag cement to elevate concrete performance
- ACI 121, QA Systems for Concrete
- ACI 325C, Precast Concrete Paving Slab
- ACI 362, Parking Structures
- ACI 544, Fiber-Reinforced Concrete and its subcommittee, 544-D, FRC-Structural Uses

The trade show floor increased to 73,000 net square feet and 375 exhibitors in 2018.

NPCA file photo

Optimism Abounds

at The Precast Show 2018 in Denver

Mark Your Calendars!

The Precast Show 2019
will take place
Feb. 28 – March 2, 2019,
in Louisville, Ky.
For more info visit
theprecastshow.com

The trade show floor buzzed with optimism at The Precast Show 2018 at the Colorado Convention Center in Denver, as more than 4,500 attendees conducted business at the largest annual precast-specific trade show in the industry.

Steady post-recession growth continued for the event. The trade show floor increased to 73,000 net square feet and 375 exhibitors – a sign that the industry is healthy and headed in the right direction, according to Ty Gable, president of the National Precast Concrete Association. NPCA, along with the Precast/Prestressed Concrete Institute, sponsors the event.

"Last year, we saw optimism and enthusiasm, and we knew there was some pent-up demand for new equipment and new technology," Gable said. "This year, that translated into more purchases and serious product comparisons on the trade show floor. I heard from many exhibitors that they sold more this year than any time since before the Great Recession 10 years ago."

The Precast Show features heavy equipment, technology and services that span all segments of the precast and prestressed concrete industry. It has been held annually under various names since 1979. In addition to the three-day trade show, the event featured

education and training courses, tours of precast plants and an industry networking event at Mile High Stadium, home of the NFL's Denver Broncos.

During the week, NPCA also announced its 2018-19 class for Leadership NPCA, held a graduation ceremony for 32 Master Precasters and 12 Leadership NPCA students from the 2017-18 class, and presented awards for plant certification and sustainability.

NPCA and PCI were joined by two participating groups: the Canadian Precast/Prestressed Concrete Institute and the Cast Stone Institute. PCI also held its annual Convention and National Bridge Conference in conjunction with The Precast Show.

The Precast Show 2019 will be held at the Kentucky International Center in Louisville, Feb. 28 – March 2, 2019. Visit The Precast Show website for details. **PI**

"Last year, we saw **optimism and enthusiasm**, and we knew there was some pent-up demand for new equipment and new technology. This year, that translated into **more purchases** and **serious product comparisons** on the trade show floor."

– Ty Gable, *NPCA president*

NPCA file photo

NPCA held a graduation ceremony for 32 Master Precasters at The Precast Show 2018.

Camp Precast:

TWO PERSPECTIVES, ONE OBJECTIVE

NPCA's **Master Precaster** graduates span all backgrounds, experiences and career paths.

By Sara Geer

Ethan Camp (above, on right) and Travis Brousseau (right, on right) gained valuable skills while taking the courses required to become a Master Precaster.

Whether you grew up in the precast concrete industry or started later in life, taking education courses can only enhance your success. Camp Precast Concrete Products in Milton, Vt., has put three employees through National Precast Concrete Association's Production and Quality School and plans to start two more this year. Travis Brousseau and Ethan Camp, who both graduated as Master Precasters in 2016, came to the program with different goals, but their perspective on how the educational opportunity has benefitted the company and industry is similar.

INVESTING IN WHAT MATTERS

Brousseau, co-owner and general manager, passionately believes that a successful business is nothing without its employees. As the company was in the middle of building its new plant, employee input meant a lot to him and co-owner Kevin Camp.

"We talked with them about what they needed, asked a lot of questions during the planning phases and basically asked, 'What works and what doesn't?'" he said. "It was important to us to keep everyone involved and updated on each step of the project."

Their approach to educating their employees is similar, but they felt one of them needed to see firsthand the benefits of Precast University courses before investing more in them. Brousseau said he was the lucky one to attend first and afterwards he had only positive things to say about his experience.

"I thought it was great since I didn't have the background or grow up in the industry," he said. "There was a lot of stuff I realized I took for granted or didn't know, and I have an engineering degree."

Brousseau said much of what he learned while taking the Production and Quality School Level II–Production course still resonates.

"I always look at it as my job to surround myself with people that are smarter than me in the areas that I put them in, but that I need to know a little bit about everything," he said. "So, a lot of the classes I took helped me to learn about things I don't do every day – quality control, batching and production. These classes helped me become a more rounded manager and leader."

Brousseau added that graduating as a Master Precaster helped him recognize just how important industry-specific training is for the company. Not only will employees who are interested in making precast concrete a career be appreciative of the company's commitment, but they are also receiving knowledge and training essential to success in their current jobs. Brousseau and Camp plan to start putting two or three workers through the program at a time.

"One thing that I noticed about Ethan (Camp) after he attended classes is he answered more questions at the weekly QC/QA meetings," Brousseau

said. "He has more confidence. When I see employees do that, it's fantastic."

CREATE YOUR OWN PATH

To join or not to join, that is the question family members face with when considering the family business. Ethan Camp never thought about working with his father, Kevin, until high school. He worked summers at Camp Precast for nearly four years before starting full time after college. He is a quality control technician and a production crew member.

"I've enjoyed working for the family business thus far, and it has lasted beyond anything else I really wanted to do," he said.

Through his father's NPCA and industry connections, Ethan had already been networking with and learning from many precasters about the industry. However, not until taking NPCA's PQS Level I course did he have the motivation to take the next step in his career.

"PQS I was the class that was truly eye-opening for me about things that related directly to my job specifically and the industry," he said. "Even after working all those summers, it showed me that there was a lot more in precast than doing the daily work."

Now, after graduating as a Master Precaster, he's able to better understand the technical concepts shared by those precasters he networks with. In addition, he has become a mentor to employees at Camp Precast by connecting his work ethic with the course knowledge to not only tell, but show co-workers how to perform daily operations in the plant.

> "The **best part** about working in the precast industry is there are always **new things** coming out to learn."
>
> – Ethan Camp, *Camp Precast*

"It's definitely been beneficial for our employees because they understand better what I'm talking about, how we do things and it's better for the company," he said.

Ethan said he's noticed, for example, that ensuring employees know how to vibrate a product correctly makes a difference in improving efficiency. If everyone is thinking similarly, communication and quality does not have to suffer, he said.

He continues to take courses every year to increase his knowledge and still regularly uses his notes from previous courses for problem solving and review.

"The best part about working in the precast industry is there are always new things coming out to learn – standards, processes, etc.," he said. "It all inspires me to maintain my education and keep going with everything I know so far." **PI**

Sara Geer is NPCA's internal communication and web manager and is managing editor of Precast Inc.

For more information on NPCA's Master Precaster program, visit **precast.org/precastuniversity**

People & Products

People & Products is a **forum** where NPCA members and nonprofit organizations can **share information** on new products, personnel promotions, acquisitions or service announcements **concerning the precast concrete industry**. Items are printed on a space-available basis.

For possible inclusion, send your press releases and photos to sgeer@precast.org.

EUCLID CHEMICAL COMPANY LAUNCHES NEW WEBSITE

The Euclid Chemical Company launched a new website (euclidchemical.com) designed to make it easier to find the technical information customers need while on the job.

A new addition is a project database where users can browse through project profiles. Users can also now access a library of technical data, brochures, sell sheets, application guides, technical bulletins, specification guides and product certifications and easily access product documents. Also incorporated within the new website is Euclid Chemical's FiberCalc app for calculating TUF-STRAND SF fiber dosages.

COMMAND ALKON CELEBRATES 2018 SUPPLY CHAIN PROS TO KNOW AWARDS

Command Alkon announced Monty Newport, senior vice president, and Chris Strickland, VP, products, have been selected as 2018 Supply Chain Provider Pros to Know by Supply & Demand Chain Executive magazine. The two were chosen for being instrumental in helping clients transform their supply chains by using state-of-the-art, digital supply chain solutions and services. Newport has worked at Command Alkon for 26 years and Strickland has been with the company for 16 years.

PRESPAN FLOOR SYSTEM LAUNCHED BY NORTHEAST PRECAST

Northeast Precast announced the issuance of a patent on a new flooring system. PreSpan is a new insulated precast floor plank product developed by Northeast Precast. The product has the most benefit for residential and small commercial projects and allows for extra space to be constructed under the garage in the building stage of a project. The precast floor system allows for a complete open space with no columns or load-bearing walls.

PreSpan Floor System

Frank Bowen

ROSETTA HARDSCAPES WELCOMES NEW BUSINESS DEVELOPMENT REP

Rosetta Hardscapes announced the hiring of Frank Bowen as a business development representative. With nearly 13 years of experience in the precast industry and a master's degree in business management with a focus in concrete industry management, Bowen will be responsible for introducing the Rosetta business opportunity to the market. Bowen spent the past 13 years working at his family's company, Piedmont Precast.

MOLDTECH ADDS SELF-PROPELLED 'GIRAFFE,' OPENS CAROUSEL PLANT IN INDIA

Moldtech has added a self-propelled concrete transportation device called the "Giraffe" to its product line. The Giraffe transports and then pours concrete into the form, freeing up the gantry crane to

Moldtech's automatic carousel plant

move product. The capacity of the hopper is 4 yd^3, while the unloading arm extends up to 4.4 yards at angles ranging from horizontal to 17 degrees.

In addition, Moldtech designed, supplied and commissioned an automatic carousel plant for precast hollow columns near Navi Mumbai, India. The pallet circulation system is comprised of different stations. The system is the result of years of investment in new design software tools and continuous training of its technical staff.

BUY AMERICA CERTIFIED WIRE NOW AVAILABLE FOR MAX REBAR TYING TOOLS

Buy America-certified tie wire is now available for MAX rebar tying tools. The product, TW898 USA wire, is melted, annealed and drawn in America and can be used with the MAX RB397, RB398, RB517 and RB518. The product is an uncoated steel tie wire and is widely available through concrete dealers throughout North America. Mill certificates are available through MAX USA upon request.


Derek Von Cannon

SPILLMAN ADDS NATIONAL SALES MANAGER, ANNOUNCES DESIGN SOFTWARE

Derek Von Cannon has joined the team at Spillman Company as national sales manager. He will primarily be focusing on the resale portion of the business and will be responsible for the southern states, upper Midwest, and Plains region. Von Cannon comes to Spillman from Advanced Drainage Systems, where he specialized in the Nyoplast line and Geosynthetics for more than fifteen years.

Spillman has also announced a new design software in conjunction with IconXusa for use with Icon composite shear connectors. The new beam spring model used in Icon's design software takes into consideration each member to yield accurate deflection and moment calculations. The software adjusts Icon spacing to optimize performance while minimizing insulation waste, and allows for different wythe thicknesses as well as using a combination of Icons (both glass and carbon fiber) in the same panel.

MARTIN ENGINEERING INTRODUCES NEW VIBRATOR FOR THE PRECAST INDUSTRY


Martin UI-1600

Martin Engineering has unveiled a new vibrator for precast concrete applications. The Martin U1-1600 High Frequency Electric Vibrator is made in America and constructed with durable, lightweight materials for a total weight of 23 pounds. The design is also made to be portable using the easy-grip handle attachment for swapping between forms. **PI**

CALENDAR OF Events

Oct. 4-6, 2018
NPCA 53RD ANNUAL CONVENTION
Omni Providence Hotel
Providence, R.I.

Feb. 28 - March 2, 2019
THE PRECAST SHOW 2019
Kentucky International Convention Center
Louisville, Ky.

Oct. 3-5, 2019
NPCA 54TH ANNUAL CONVENTION
Hyatt Regency Seattle
Seattle, Wash.

March 5-7, 2020
THE PRECAST SHOW 2020
Fort Worth Convention Center
Fort Worth, Texas

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

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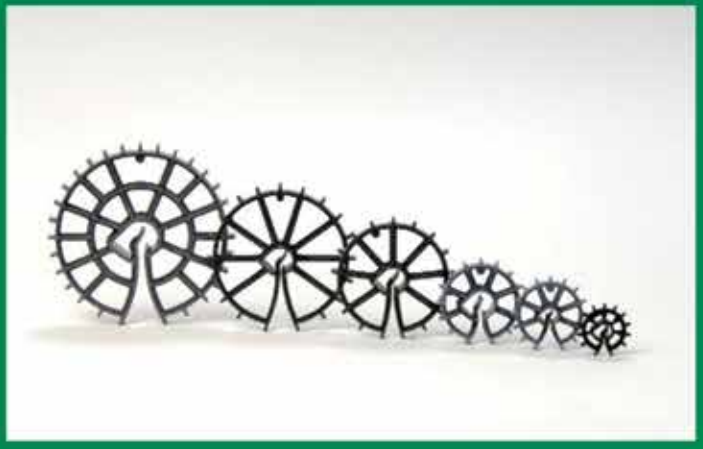

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