Variation in Concrete Performance Due to Batching

Effective Communication
The Sustainable Aspects of Concrete – Practicing How We Say It
Formulating Solutions for Sustainable Construction

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Here is a water heater with a proven performance record in the ready mix concrete industry. Those who bought these heaters have nothing but praise for their performance. Keith Thornton, Kinsley Construction, Inc in York, PA lauded his Firestorm® heater in a lengthy letter he sent us.

His company purchased a Firestorm heater late 2007 when their existing water heaters failed to keep up with increased production demands. The temperature of their city water drops to 38 degrees F in January, but mix temperature has to be 70 degrees F.

After the Firestorm heater was delivered, it was up and running in two days. The first day of production for the new heater enabled them to make 1,200 yards of concrete in eight hours. They had hot water all day for the mixes and also for the trucks. The following three months had several days with temperatures below 20 degrees. They produced 75 degree concrete using water heated by the Firestorm heater. Their production costs fell from $2.38/yard to $0.63/yard, including the cost of the heater. The heater's thermal efficiency exceeded expectations.

Thornton went on to say that this one piece of equipment had cut production cost, reduced loading times, raised driver morale, increased customer satisfaction and pleased management.

We rest our case.
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Please visit the electronic version of Concrete Infocus at http://www.nrmca.org/news/connections/ for bonus features, including “Ready Mixed Concrete Industry Data Report,” “The New Frontier for Pervious Concrete: Wearing Course Applications,” “Workforce Issues Q&A” and “Best Sellers from the NRMCa Book Store.”
Variation in Concrete

Part 8 of Concrete Quality Series

By Karthik Obla, Ph.D., P.E., Vice President, Technical Services

Parts I and II of the Concrete Quality series discussed that a good measure and benchmark of concrete quality is the Standard Deviation (SD) of compressive strength test results. The primary factors that impact the SD are variability associated with materials, production and testing. In order to reduce the strength standard deviation the concrete producer needs to manage those aspects of variability that can be controlled. This article discusses the benefits of controlling accuracy of batching of concrete material ingredients other than water. Effects of batching inaccuracies of water and ways to reduce it have been addressed in earlier articles.

ASTM C94 Scale Accuracy and Accuracy of Plant Batching

ASTM C94-11 states that scales shall be considered accurate when at least one static load test within each quarter of the scale capacity can be shown to be within ±0.15% of the total capacity of the scale or 0.4% of the net applied load, whichever is greater. The NRMCA Plant Certification Check List invokes these requirements through the range of use of scales. The certification requires companies to verify scale accuracy at least once every six months and arrange for prompt recalibration and correction if non-compliance is indicated or if the plant is moved or other maintenance impacts the weighing systems. The accuracy of volumetric measuring devices in the NRMCA Check List for water and chemical admixtures is established by the required batching accuracy. NRMCA certification requires that volumetric measuring devices should be checked for accuracy at least once every 6 months.

ASTM C94 and ACI 117-06 state the tolerances for batching ingredients of concrete. The batching accuracy requirements in the NRMCA Plant Certification program are as required in ASTM C94 and stated in Table 1. For weighed ingredients, accuracy of batching is determined by comparison between the desired weight and the actual scale reading; for volumetric measurement of water and admixtures, accuracy is determined by checking the discharged quantity relative to the target, either by weight on a scale or by volume in an accurately calibrated container. Volumetric measurement is commonly used for water and typically used for chemical admixtures. It is realized that on any single batch, at least one of the ingredients may be out of tolerance, as discussed later. For the NRMCA plant certification, inspectors are advised to review several batch records and to determine that the plant complies with the batching accuracy by reviewing the average of at least 10 batches of concrete.

Two Issues with Batching

The above requirements are essential first steps for ensuring batching accuracy. Concrete producers should continuously review batch records to ensure that batch weights of all the ingredients of concrete are
within the ASTM C94 batching accuracy requirements. Concrete plants may have to be tuned, continually monitored and adjusted when necessary. If this is not practiced two possible errors may occur:

1. Over batching materials means giving material away and increased material cost per cubic yard produced. Under batching results in under yield causing customer complaints.
2. Batch weights that are highly variable can cause significant variations in yield, strength and other performance characteristics of concrete. It also results in poor inventory control of ingredient materials at the plant.

**Over batching**

Fig. 1\textsuperscript{4} shows the cement over-batch in dollars from a fairly new concrete plant producing approximately 200 yd\textsuperscript{3} per day. It is clear that for the first month (June 1 to 30) the plant was on an average over-batching about 10 lbs/yard\textsuperscript{3} of cement. Between June 30 and September 30 the over-batching continues upward in a series of ever shortening steps. This is due to attempts to tune the plant using the batch computer as the plant continued to become more and more mechanically unsound. It can be easily seen at what point the plant fails. It is also apparent that once the plant was repaired to a proper mechanical condition, that the batch computer had in fact been tuned to an under-batch condition in order to correct a deteriorating mechanical condition that had been causing the plant to over-batch. Once the plant was repaired and the computer properly tuned, more accurate batching was possible as reflected by the almost flat line starting about November 20.

Fig. 2\textsuperscript{4} represents what can be achieved in batching accuracy when attention is given to all materials. This figure represents five plants producing almost 3000 yd\textsuperscript{3} per day. Note that this figure represents five months of production totaling over 300,000 yd\textsuperscript{3}. Total material over-batch was reduced to an average of $0.013/yard\textsuperscript{3} for the five-month period. This type of performance requires constant monitoring and constant preventive maintenance.

Another producer\textsuperscript{9} reports similar reductions in over batches. Fig. 3 (upper plot) is a timeline graph (over 2 years) of sample averages of cement batch weights of 3 consecutive batches of concrete. Each data point was the average of cement batch weights for 3 consecutive concrete batches for the same mixture. At least 2 such points were collected per day and so the whole plot consists of 663 data points. At the beginning, cement was being over-batched on average about 5 lb/yard\textsuperscript{3} over the target weight.

**Variation of Batch Weights and Its Effects**

The second important issue with batching is the variation in batch weights. In 2006, a survey of batching accuracy was conducted\textsuperscript{10} while developing the NRMCA Plant Inspectors Guide for the purpose of evaluating how inspectors can check batching accuracy during a plant inspection. Data was received from 31 concrete plants with batch records from 10 consecutive batches for each of two days. This produced 620 batch records. Actual batch weights were
and Corresponding Range in lb/yd³

consecutive batches of concrete (upper) and Corresponding Range (Lower) 2 data points plotted each day of production.

Cementitious Batch Weight Variation and Its Effect on Strength Variation

For a given concrete mixture, variations in cementitious batch weights can be expected to lead to strength variations. A commonly used rule of thumb is that 1 pound of cementitious material equates to a compressive strength between 8 to 12 psi. (This is a simplistic assumption that is valid only for w/cm around 0.50 to 0.60 or concrete with 28-day compressive strength ranging from 4000 to 5000 psi). This means that a ±1% variation in cementitious batch weight will result in a ±1% compressive strength variation. If the cementitious batch weight varies by ±1% of the target value 95% of the time, the effect is that the resulting compressive strength variation should be within ±1% of the average strength 95% of the time. For the purpose of this analysis it is also assumed that the cementitious batch weight and the resulting compressive strength of the concrete are normally distributed. If 99% of the time it is within tolerance then it follows that 97.5% of the time the cementitious batch weight is more than the lower tolerance limit and as a result 97.5% of the time the compressive strength of the concrete should be greater than the strength corresponding to the cementitious batch weight at the lower tolerance limit.

So, for the 97.5% probability, it follows that:

\[ X - 1.96s = (1-y)X \]

where X is the average compressive strength; y = variation in cementitious batch weight (0.01 for 1%; 0.02 for 2% etc.); s=standard deviation of resulting compressive strength test results.

Simplifying, we get

\[ s = \frac{y}{1.96}X \]

If X=5000 psi, s can be calculated as given in Table 3 for the various cementitious batch weight variations. Table 3 shows that the resulting strength standard deviation varies linearly with the cementitious batch weight variation. ACI 214R-02 states that for laboratory trial batches the overall standard deviation for excellent standard of concrete control should be below 200 psi. To attain an overall standard deviation of 200 psi, assuming very good testing standard deviation of 140 psi (COV of 2.8% for average 5000 psi concrete which corresponds to Very Good testing control), one would have to target a standard deviation of less than 140 psi for material and manufacturing and initial curing variations! Cementitious batch weight is one of numerous variables affecting compressive strength variability. Considering this, the standard deviation of more than 25 psi due to cementitious batch weight alone may be too high. The analysis of the NRMCA batching survey in Table 2 shows that for cementitious material 95% of the batches are within ±2%. If a concrete producer is reviewing these records, a suggested target for improvement would be to ensure that the cementitious batch weights should be within ±1% in 95% of the batches. As a process of continuous improvement, once the 95% target level has been attained producers can aim for 99%. One company has reported to have attained batching accuracy of 99.9999% or only 1 in a million batching failure rate and has quantified significant material cost savings as should be expected!

While cement is usually the primary focus of any plant analysis, all materials are subject to variations in batching and all have an effect on the quality of the concrete. Batching inaccuracy can be cumulative. A 2% reduction in cementitious batch weight in addition to a 2% increase in aggregate batch weights in the same batch can lead to a 4% reduction in cementitious weight when concrete is adjusted for yield thus resulting in significant concrete performance variation. Also, admixture dosage

Figure 4. Statistical Process Control Charts – Average of three consecutive batches of concrete (upper) and Corresponding Range (Lower)

Figure 5. Control Charts for the Fine Aggregate Batching Process over 2 years at a Ready Mixed Concrete Plant – Average fine aggregate weight in lb/yd³ of three consecutive batches of concrete (upper) and Corresponding Range in lb/yd³ (Lower). 2 data points plotted each day of production.
C94 cement batching tolerance is ±1%.

Table 1. Batching accuracy requirements per ASTM C94 and NRMCA Plant Certification

<table>
<thead>
<tr>
<th>Check List Section</th>
<th>2.5.1</th>
<th>2.5.2</th>
<th>2.5.3</th>
<th>2.5.4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Material</strong></td>
<td>Cementitious Materials</td>
<td>Aggregates</td>
<td>Individual Batchers</td>
<td>Water, Vol. or Wt.</td>
</tr>
<tr>
<td><strong>Basic Tolerance</strong></td>
<td>± 1% of desired weight</td>
<td>± 2% of desired weight</td>
<td>± 1.5% of desired weight</td>
<td>± 3.0% of desired weight</td>
</tr>
<tr>
<td><strong>Intermediate and cumulative</strong></td>
<td>Intermediate and cumulative</td>
<td>1.0 gal (10 lb.)</td>
<td>Minimum dosage rate per 100 lb. cement</td>
<td></td>
</tr>
<tr>
<td><strong>Small Batch Tolerance</strong></td>
<td>-0 to +4% of desired weight</td>
<td>± 0.3% of scale capacity for loads below 15% of scale capacity</td>
<td>± 0.3% of scale capacity for loads below 30% of scale capacity</td>
<td>Whichever is greater</td>
</tr>
</tbody>
</table>

Table 2. Analysis of Cement Batching from a NRMCA Batching Accuracy Survey

<table>
<thead>
<tr>
<th>Tolerance Limits, %</th>
<th>Percent within Tolerance, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>±1%</td>
<td>83</td>
</tr>
<tr>
<td>±2%</td>
<td>95</td>
</tr>
<tr>
<td>±5%</td>
<td>98</td>
</tr>
<tr>
<td>±10%</td>
<td>99</td>
</tr>
</tbody>
</table>

C94 cement batching tolerance is ±1%.

Table 3. Cementitious Content Variation and its Effect on Concrete Strength Variation

<table>
<thead>
<tr>
<th>Cementitious Batch weight Variation, %</th>
<th>Calculated Concrete Strength Standard Deviation, psi*</th>
</tr>
</thead>
<tbody>
<tr>
<td>±1%</td>
<td>26</td>
</tr>
<tr>
<td>±2%</td>
<td>51</td>
</tr>
<tr>
<td>±5%</td>
<td>128</td>
</tr>
<tr>
<td>±10%</td>
<td>255</td>
</tr>
</tbody>
</table>

How can a company improve batching accuracy?

Once a target has been established there are different ways companies can go about to improve batching accuracy. One producer8 has used a real time error monitoring system with great success. Control systems available to the industry allow for the notification to responsible company personnel, in the form of an e-mail, whenever the set batch tolerances are exceeded. Parameters for these alerts can be set by recipient, region, plant, material and magnitude of the error. These alerts arrive in the hand of the intended recipient (quality personnel) in real time so that a decision can be made as to whether to correct the error, prevent that particular batch of concrete from being delivered to a project, divert the load to another customer or to discard the load. Real time reporting of batching errors is a good way to monitor the changing mechanical condition of a plant as well.

Another producer7 has had significant success in improving batching accuracy using statistical process control charts (Fig. 4). The upper chart is a timeline graph of sample averages of ingredient batch weights of 3 consecutive batches of concrete; 2. The lower chart is the corresponding range within the sample. In the upper chart, the straight line labeled $\bar{X}$ is the process average. The lines labeled UCL and LCL are upper and lower statistical control limits, set three standard deviations above and below the process average. The upper chart is sensitive to shifts in process average and the bottom chart is sensitive to process variation. The charts depict a process said to be in a state of statistical control - that is a process showing random variation with no points falling above or below the control limits. Process variation originates from many random common causes. When a process is operating in this manner, the probability that all points will fall within the control limits is 0.997 probability or 99.7 percent. Points that plot outside the control limits are said to come from special or assignable cause variation; these causes of variation can be easy to locate and correct. So in this respect, the charts provide a decision-making tool to identify when an assignable cause for the variation occurs that then generates an action as to correct the situation or not.

In the process described9 the plant operator was asked to plot two points each of three consecutive batches a day from the batch weight data being reported by the batch control computer. A top-selling concrete mix was picked for the evaluation. The first two batches of the day were not used as plant equipment had not yet warmed up. When the data collection was initiated quick changes were avoided. Changes were made methodically and involved resetting constants in the batch computer without any hardware changes. Fig. 3 shows control charts for the cement batching process. The point “S” on the charts in Fig. 3 is the point where this process was brought into statistical control most of the time. The points under A, B, C and D were caused by the batch control computer changing its own constants, reacting to assignable cause variation as though it were a shift in the process average.
and adjusting, where no adjustment was warranted. Initially, there were differences as high as 40 lb/yd³ between batches that could have led to significant variation in concrete performance. Similar control charts were developed for all the ingredient materials. Fig. 5 shows the control charts for the fine natural dune sand batching process. Changes to batching such as tolerances, jog timing, jog duration, time in air fall, etc. were made methodically by the plant operator. The overall result was an 80 percent reduction in the average range. In the beginning there was difference as high as 80 lb/yd³ between batches, significant enough to cause quite a bit of variation in yield, strength etc. In the lower chart the four “out of control” points under the letter A are caused by one batch in the sample going way over target batch weight just after the plant ran out of material on the previous batch. The “out of control” point under the letter B was from a modification tried. Overall for all the ingredient materials the average range was reduced by about 60%. For ingredients that are batched at very low weights (< 100 lb/yd³) it was found harder to achieve large reductions. By methodically following the process and reducing the standard deviations, the producer was able to operate at a variation less than half of the C94 tolerance for cement and aggregate batch weights thus ensuring that tolerance limits will be exceeded less than 1 in a million batches! The producer reports success in implementing statistical process control in aggregate production and paperwork as well.

The producer states that an environment of trust that is free of fear is essential for statistical process control to succeed. Initially, rapid progress can be made by making simple changes and it is important not to resort to blame someone or some group as then many of the low hanging fruit will not be accessed. The producer states that a plant operator who achieved most of the improvements shown in Figs 4 and 5 has become an advocate of continuous improvement and pride in workmanship, traits very beneficial to the company.

Another way of doing batching accuracy is by cumulative end of day, week or month method. If at the end of some time period, the total amount of material used in the concrete more or less equals the amount that should have been used then all is deemed to be well. This is a business side argument. Unfortunately, this “inventory-based” method is not useful enough to adequately establish the true performance of a concrete plant or to predict the performance of individual concrete batches. There needs to be a quality side of the argument too. A cumulative ending number only tells a small part of the story, it is necessary to determine the path to that number.

Summary
Improving batching accuracy can help reduce material over-batch and thus reduce material costs per cubic yard produced. It can also help reduce material under-batching and thus under yield that could result in poor customer relations. Improving batching accuracy can help attain more consistent performance for fresh concrete properties that is important to the contractor and to reduce variation of compressive strength of concrete. The intangible benefits of improving batching accuracy are also considerable. There will be fewer loads batched in error, and a reduction in rejected loads. Because of the constant tracking of material batching it is possible to quickly detect plants that have just had a breakdown or where one is about to occur. This helps reduce plant downtime and maintenance.

There is a cost to improving batching accuracy. It may require plant operator time for developing and tracking control charts or investing in error monitoring alerts. It may increase the time for batching materials into the ready mixed concrete truck. But the benefits far outweigh the additional costs.

References
2. Obla, K.H., “Sources of Concrete Strength Variation – Part II of Concrete Quality Series”, Concrete InFocus, July-August 2010, Vol. 9, No. 4, NRMCA, pp. 21-23.
3. Obla, K.H., “Variation in Concrete Strength due to Water and Air Content Variation – Part IV of Concrete Quality Series”, Concrete InFocus, January-February 2011, Vol. 10, No. 1, NRMCA, pp. 29-32.

*The standard deviations of the compressive strengths are calculated by assuming that the cementitious batch weights are within the noted variation 95% of the time, and the cementitious batch weights and resulting concrete compressive strengths are normally distributed.*
Two (2) NEW Portable Concrete Plants:

- **Falcon** - New super heavy plant
- **Mustang** - New low-profile portable

The Mustang plant will be exhibited at the ConExpo Show.

NEW Stephens RCC Mixer:

The new mixer will allow an existing dry batch plant to be transformed into an RCC or central mix plant.

The New RCC mixer will be exhibited at the World of Concrete Show and the ConExpo Show.

NEW Stephens/Inventure Reversing Drum Mixer:

Stephens has acquired the exclusive rights to manufacture and supply the Inventure Reversing Mixers in Canada and the USA. The new design and updated frames will make the mixer even more maintenance friendly.

The NEW Stephens/Inventure Reversing Mixer will be exhibited at the ConExpo Show.

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New heavy portable Falcon

- Standard frame will support up to two 1000 bbl silos
- Standard frame will support up to 200 ton agg bins
- Optional frame will support up to 400 ton agg bins
- Plant can be designed with 36” belt, water batcher and holding tank for 200 yph production
- Central dust collector can also mount on plant to save yard space
- Standard frame to be designed to typical zone 1 seismic calculations

New low-profile Mustang

- 400 bbl in truss silo
- 70 ton agg bin
- 30” transfer belt
- Two (2) 10” screws
- Optional: in truss central dust collector available
- Standard frame designed to typical zone 2 seismic calculations

New RCC Mixer Includes:

Sicoma MAO-6000 twin shaft mixer
- 42” transfer belt with 50 hp motor
- 400 amp 3rd party UL approved power panel
- Optional: Hydraulic Leveling Jacks
- Hydraulic Conveyor Fold
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Unique Features:

The newly designed frame will make clean-up and maintenance easier, and the new design will allow for a water hose or broom to easily clean under the mixer.

The patented “swing out” hinged charging chute also allows for quick and easy access inside the mixer.

Stephens has added several other options as standard equipment.

The new Stephens/Inventure mixer will be exhibited at the ConExpo Show, booth # 5707.
Have you heard the term “Elevator Speech” before? It’s when you’re on an elevator with someone, the doors close and instead of the awkward silence, you strike up a conversation. If it comes to the question, “What do you do?” or “Who do you represent?”, then you’ve only got a few seconds to share with that person something valuable about yourself that might make an impression. That’s the elevator speech.

As representatives of the concrete industry, we get the opportunity to give “elevator speeches” in many different situations. For instance, on jobsites with contractors or engineers, at construction industry conferences, at USGBC local chapter meetings, in our local communities, even with our neighbors. For many of us, our concrete industry hats are worn ALL the time. So, what’s your elevator speech sound like? Don’t be ashamed yet, you’re not alone. (And I write “yet” only because after you read this article, if you’re not inspired to sit down and practice your take on what you do and who you represent, then at that point you can feel free to be ashamed.)

Most of us in this industry haven’t put in the time it takes to hone our concrete industry “elevator speech”, or let’s start calling it our concrete industry “Intro” speech. Let’s face it, sometimes we may only get a few seconds to plant that seed of interest or negate that misconception about what we do or the product we represent. This article is an attempt at bringing home the point that individually and as companies we could do better at communicating our passion for the world’s most versatile, environmentally friendly building material. We are missing golden opportunities to spread the word simply because we are not prepared to effectively communicate it.

Let’s look at the MIT Concrete Sustainability Hub as an example. The industry, both cement and concrete, have invested millions of dollars in the MIT CSH in order to not only better understand the sustainable aspects of concrete and cement, but also to validate much of what we already know about concrete’s vast contribution to sustainable
construction. In August, MIT issued its second year report on what’s been happening at the CSH; in fact many reading this article may have attended the August Industry Day at MIT to get a firsthand account of the results.

Thus the question is, how many of us who attended that Industry Day or who took the time to review the reports (lots of pages written by MIT brains) can effectively communicate to someone inside or outside our industry on what the results were? Don’t be ashamed yet, you’re not alone. Both PCA and NRMCA have been hard at work developing fact sheets and talking points along with PowerPoint presentations aimed at helping our industry better understand what’s going on at MIT. These are valuable resources we should all take advantage of. The problem is, what good are all these fact sheets and talking points unless we actually learn what’s in them and then take that knowledge and effectively communicate it….That’s where we fall short. For most of us, the thought of learning and regurgitating detailed MIT research reports is on par with scheduling a visit to a proctologist. Avoid and ignore!! So we go about our daily business and hope someone else will do it.

Given these facts of human nature and the cries from many to “dumb down” the MIT research reports so they can be better understood and communicated, how about we take a different approach? Why don’t we focus on what we do know and become experts in communicating that information?

Concrete is one of the most sustainable products on the planet. It has many different environmental benefits that most in our industry know, yet may find it hard to communicate at a moment’s notice. Simply take the test, right now, out loud, pretend you’ve got a camera on you and you were just asked to tell a reporter what the environmental benefits of concrete are….If you really did try this exercise, then you know how difficult it is to come up with an “off the cuff” statement that is both coherent and effective about something that you thought you knew. If you didn’t try, stop reading now because you may be a lost cause. Practice makes perfect. Effective communication is about practicing your message and delivering it successfully.

So what are some of the major points we’d want to make regarding the sustainability of concrete? Well, we know concrete is perishable, so it has to be produced fresh each day which means it also has to be produced locally. Local production means less transportation costs both environmentally and monetarily. Local production also means local jobs, boosting the local economy.

Concrete is light in color which lowers illumination costs for buildings and pavements. Light reflectance helps reduce the Heat Island Effect which in turn means lower cooling costs for a given facility in the summer. A reduction in the Heat Island Effect also helps reduce smog which can contribute to health related problems among both the very young and the very old. LEED recognizes concrete’s contribution to lowering the Heat Island Effect in parking lots.

Concrete is Durable. It stands the test of time and Mother Nature. It doesn’t rust, rot or burn. When you consider the energy and materials wasted by rebuilding homes devastated by natural disasters and repaving our roads regularly due to failing asphalt, if they had been built with concrete in the first place, their durability in most cases could have prevented this waste of valuable resources. MIT is validating these facts with its life cycle assessment of concrete structures and pavements.

That’s certainly not all the sustainable aspects of concrete, but it’s a great start. With a little dedication and practice, we all could effectively communicate these sustainable attributes of concrete. Unfortunately, many of us think we can, assume we can, but haven’t put in the time to make sure we can. Being a professional, whether it’s pro football or sales and marketing, takes practice. Football teams practice their plays over and over until they become second nature. If we are out there communicating to the construction industry about our exciting product, doesn’t it make sense to have practiced our verbal delivery?

Understanding the message

Perfecting our “industry Intro” speech, whether it’s a general approach to serving the concrete industry or focusing on the sustainable aspects of concrete, it all starts with understanding what message you want to deliver. If I’m attending a USGBC local chapter meeting and get the opportunity to stand next to someone at the lunch buffet line, I’d be best served by having a short explanation of why I’m there and what I do. Examples:

With no preparation:
USGBC Attendee: “So what do you do?”
Concrete Industry Representative: “I work for XYZ Materials, we sell concrete.”

USGBC Attendee: “Oh, could you excuse me, you’re uninteresting and I’m pretty sure your product pollutes the environment.”

With a little imagination and preparation:
USGBC Attendee: “So what do you do?”
Concrete Industry Representative: “Thanks for asking. I represent one of the oldest, most versatile and sustainable building materials on the planet. You could say that it’s not only the foundation of our modern day lives, but our country’s infrastructure relies on our product. Care to guess?”

Understand that you’ll have to come up with what works for you, but in this example,
with a little preparation, you’ve opened up the conversation with a bold statement that might lead to a legitimate dialog with this person that could open up an opportunity you didn’t even know existed just a few short moments ago.

In another example, we could go back to our discussion on the MIT CSH. How would you craft a statement that best explains what’s going on there?

With no preparation:
“Yeah, MIT is studying concrete and how it’s a sustainable product, um, we’ve sunk millions of dollars into the research.”

With a little imagination and preparation:
“We’ve known for years that concrete is the most sustainable building material available today. It’s durable, offers energy efficiency, is locally produced and is recyclable. MIT researchers have now developed a cutting edge Life Cycle Assessment model that can quantify the cradle-to-grave environmental costs of paving and building materials far more accurately than ever before. They are validating with scientific research that concrete buildings and pavements offer real reductions in global warming potential emissions.”

Remember that unless you are making a formal presentation, your comments need to be short, concise and to the point. Most of us can’t do this “off the cuff”. Most of us need to prepare, which means being committed to spend the time to do the preparations. Have you ever written down talking points about a particular issue? Have you ever rehearsed verbalizing those talking points? Have you ever videoed yourself giving a presentation or simply speaking to someone? I realize it sounds odd, but it’s the best way for you to see yourself and how you come across. Being an arm flailer and using “ah” and “um” were two traits that I would never have associated with my presentations, UNTIL I saw myself on video flailing away between “um’s and ah’s”. The reality is there are few individuals in the concrete and cement industry who are polished, extraordinarily gifted communicators. We could all improve, and that’s the point. Taking the time to prepare our “Elevator speeches” and working to eliminate our negative communication habits is a valuable way for our industry to help ourselves move forward. We represent an amazing product, concrete, with so many valuable attributes. How is it that most people don’t know the difference between cement and concrete? Because we haven’t been effective in telling them!

There is hope! Toastmasters is a national organization with chapters in every city in the country. Its goal is to improve presentation skills with real world experience and friendly, helpful evaluations of your current level of communication effectiveness. NRMCA is also offering a new Webinar that goes into detail about how to improve our communication skills, with a focus on sustainability. More information can be found at www.nrmca.org/webinars or contact doneill@nrmca.org. Honing our skills as communicators is just another way our industry can better compete in the very difficult business environment we find ourselves.

As our industry becomes more effective at translating the considerable advantages of concrete to the marketplace, that higher level of professionalism will only push us further ahead and uncover the best and the brightest that will be able to take the lead in advancing the new technologies and innovations this industry continues to develop.

Contact Headwaters Resources for free technical literature and information on how fly ash use benefits the environment and produces better concrete.

**SPECIFY FLY ASH**
(a recovered resource)
as a replacement for cement in concrete.

When you specify fly ash as replacement for cement in concrete, you help reduce CO₂ emissions from cement production, conserve landfill space, and decrease water usage. You also enhance workability and chemical attack resistance, increase strength and produce more durable concrete.

Contact Headwaters Resources for free technical literature and information on how fly ash use benefits the environment and produces better concrete.
This is the third article in a series intended to aid in the initial training or upgrading of your sales force. Selling is a complicated process. By eliminating these common mistakes salespeople can become both more effective and more efficient, the two levers used to maximize your sales team’s efforts. The common mistakes we will focus on are:

- Talking instead of listening
- Not having a process
- Not understanding the decision making process
- Allocating time improperly
- Selling what you want to sell, not what they want to buy
- Believing everything you hear
- Getting emotionally attached to the deal

Our last article looked at the selling process. This edition we are going to look at the decision making process. Understanding the players, their roles, relationships and money flows always increases the odds of winning a deal. First let’s take a look at buyers roles. In each deal, a buyer has a role to play. It may be the same on all deals; it may vary based on the size or complexity of the deal. Bottom line, you need to identify all the players and understand their roles. Typical roles I like to use are:

- **Decision Maker**: Someone who individually or in a group will make a decision. He or she gets a vote.
- **Internal Advocate or Champion**: A person who carries your message for you when you are not there. He or she is a vocal advocate for your deal. Having a champion significantly increases your odds of success.
- **Influencer**: A person whose opinion may impact one or more decision makers.
- **Vetoer**: A person who can veto your deal. Vetoers are usually decision makers, but not always.
- **Gatekeeper**: A person who stands between you and a decision maker who you must get by to gain access.

So now that we have identified what role the various people have in the decision process, the next piece of the puzzle is how are they going to make the decision. Is the decision a committee? Who votes? Is it a single decision maker? If so, which influencers matter most? Is there politics involved? I think you see where I am going. Understanding the landscape around the decision makers and key influencers can provide critical information to formulate the best tactics to win the deal.

Once we understand who is involved and how he or she will make a decision, understanding buying motives will increase our odds. Dealing in the construction industry, even before this recession, many purchase only on first cost. Unfortunately, we are sometimes lulled into thinking it is the prime buying motive all the time. The only way to know for sure is to be in the trenches, asking the questions, confirming important information from multiple sources. Let’s not assume it is the prime buying motive. Sometimes, speed of construction and other needs will trump first cost. Life cycle cost is replacing first cost in more and more places. Once you know what the decision makers need are, you can meet them. If you don’t know their needs your tactics could be flawed and your odds of success go down.

As with any sales interaction, spend more time listening and less time talking. Use open and closed probes to uncover needs and present the solution to their needs. The more decision makers, the more needs and the more complex the likely process. Understanding the roles and process increases close rates significantly. Selling is like playing the piano. You have to practice to get better. The better you understand the buyers roles and the decision making process the greater your chances of success. It allows you to meet the needs of the customer, apply leverage where it can help win the deal and increase closing rates. The kind of skills that can help you get parking lots and streets and local roads!
The New Frontier for Pervious Concrete: Wearing Course Applications

By Jennifer LeFevre, RMC Research & Education Foundation Senior Director, Communication & Programs

Pervious concrete is becoming a staple for sidewalks and parking lots nationwide and its many attributes are helping to convince designers and builders to utilize it more often than ever before. Proponents of pervious concrete have long been itching to bring these positive attributes to streets and local roads – and even to highway applications. But although pervious concrete has been around for quite some time, it has yet to gain popularity in applications beyond sidewalks and parking lots. The potential for noise reduction and the enhancement of skid resistance and reduced road spray would make the use of pervious concrete a winner in this application, given the strong safety and positive environmental elements it would bring. Design challenges for using it in wearing course applications, however, in the United States, Canada, and in Europe, caused many to dismiss the notion that pervious concrete could ever be widely used for streets, local roads and highway applications. Studies conducted in Europe and Canada were unable to overcome some of these challenges. However, the leadership of the RMC Research & Education Foundation felt those researchers gave up too soon and therefore voted to co-fund a comprehensive study to examine those areas that were of particular concern. The Foundation worked in partnership with the Federal Highway Administration, the U.S. Department of Transportation’s Pooled Resource Fund, the American Concrete Pavement Association, and the National Concrete Pavement Technology Center (CP Tech Center) at Iowa State University where the study was conducted resulting in a comprehensive evaluation of some of these challenges and how to overcome them.

The final report released last fall, An Integrated Study of Pervious Concrete Mixture Design for Wearing Course Applications, identified and studied several areas where the use of pervious concrete might be more challenging when compared to using traditional concrete. Studied areas include pervious concrete air entrainment and its impact on durability, pervious concrete workability and placement issues, pervious concrete overlay mixture development, curing and surface durability, durability to deicers and design considerations to reduce potential clogging. The research also took into consideration freeze-thaw issues.

The researchers prepared the chapters as stand-alone documents so that readers may review only those areas in which they are most interested without losing important information or context. The project plan called for a combination of review of previous work such as the evaluation of in-place pervious concrete sections and review of mixture design elements followed by actual construction and long-term testing and field reporting. With respect to the mixture development task, the researchers evaluated a large number of mix designs incorporating a wide variety of aggregate types and sizes, cements and admixtures. Much of the field placement and testing took place at Iowa State and at the Minnesota Road Research Project (MnROAD). Ultimately, the research team designed and constructed a wet-on-dry pervious concrete overlay at the MnROAD facility – which has been subjected to harsh Minnesota winters – that has been performing well with respect to surface durability, hydraulic performance and low noise, for over three years. The study also led the researchers to make additional recommendations for future research to help advance the use of pervious concrete as a wearing course application.

In addition to the new CP Tech Center study, the Foundation also recently released the revised edition of its popular Pervious Concrete Research Compilation, including new and updated links to many pervious concrete research reports, studies and articles. The electronic version of the document allows internet-connected readers to simply click and access most of the references included. Originally released in 2006, the document...
was again updated by Dr. Heather Brown, program director for the Concrete Industry Management (CIM) program at Middle Tennessee State University. Both the new wearing course application study and the revised compilation are welcome additions to the Foundation’s already strong library of pervious concrete resources (see box) and are available from the Foundation’s Web site at www.rmc-foundation.org, as hardcopies, and on the Foundation’s popular Research Supporting Sustainable Development deliverables CD.

Additional information about the RMC Research & Education Foundation’s work, including the exciting research taking place at the Concrete Sustainability Hub at the Massachusetts Institute of Technology, may also be accessed from the Web site at www.rmc-foundation.org where many other Foundation-funded resources are also available for download. Another excellent resource for pervious concrete information is www.perviouspavement.org.

Pervious Concrete Street Project Spotlight:
Shoreview, MN, has an excellent example of a 79,000SF (3/4 mile) pervious concrete road project paved in 2009 in the Woodbridge neighborhood. Check out the YouTube video at http://www.youtube.com/watch?v=s_j.20xRPhExY to view a demonstration. An excellent summary of the project may also be found at http://www.terraroadalliance.org/publications/enews/documents/ShoreviewPerviousWebinar.pdf.

Our workers’ compensation insurance carrier keeps trying to convince us to adopt a Light-duty Return-to-work Program (RTW).

Q Why would we want to bring a worker back who is not capable of doing his regular job?

A Modified/Light-duty Return-to-work Programs are a key component in successful case management of on-the-job injuries. The Bureau of Labor Statistics reports that the longer an injured worker is out, the greater the chance he’ll never return to work. That’s BAD news for both the company and the injured worker. THE BEST WAY TO CONTROL WORK COMP COSTS IS TO AVOID INJURIES. THE SECOND BEST WAY IS TO GET INJURED WORKERS BACK TO WORK AS SOON AS POSSIBLE!

Employees injured on the job often have temporary physical restrictions that prevent them from performing all their regular job duties. A typical response is to keep the employee out of work until he or she is able to return and perform all regular or essential job duties. A formal and carefully managed modified/light duty return to work program will allow an employee who has some temporary physical restrictions to return to work to and perform duties that meet the temporary physical restrictions until he or she is able to return to the regular job duties or it is determined that he or she has more permanent physical limitations. This is a pro-active approach to rehabilitating injured workers. It’s a program you can feel good about and can implement without discrimination. You can consult with your workers compensation carrier to help you find a RTW program that will fit your company needs. It should be one that both the company and the employees view as a BENEFIT. Take time to educate your managers on the benefits and why it’s important to keep their team positive about the returning injured team member. In addition to statistics that show a faster recovery period, the returning worker is also able to earn an income while providing value added work.

It’s important to communicate with local managed care facilities and local doctors to let them know your philosophy on return-to work and that your company will provide light-duty work. It’s important to provide the doctor with a clear job description so that s/he knows the essential job duties and physical requirements. Always remember that the injured employee’s doctor will document any physical restrictions. Be sure to follow the restrictions to avoid potential liability and further injury to your worker. If done properly, this is a win/win and could be regarded as the best benefit you have!

When asked about their employer’s commitment to returning injured workers to active duty as soon as possible, one company’s employees said that they felt that their employer, “Really cares about us and our health. They’ll even give us a ride to work if our injury keeps us from driving.” The same company points out that this pro-active approach, coupled with a commitment to safety, has helped bring their worker’s compensation modification rate down from 1.39 to .78! It worked for them; it could work for you too!
Best Sellers from the NRMCA Bookstore

Technical Related Publications

1. **PCIP100 – Concrete In Practice Package** - Concrete in Practice Sheets are short 1-page discussions on various concrete topics and are written in a “What? Why? And How” scheme and are intended to provide information on a non-technical format. The CIP topics are researched and written by members of NRMCA’s Research Engineering and Standards Committee. These are a great resource to give to your contractors and customers. *English CIP Full Set 2PCIP100 - contains 20 sets of each CIP topics 1-42. Spanish CIP Full Set 2PCIP100es - contains 20 sets of each CIP topics 1-42. ($220 members, $320 non-members);* *English Single Set 2PCIPS & Spanish Single Set 2PCIPSes* ($27 members, $110 non-members)

2. **2P170 – ASTM Standards for Concrete**
   - **Technician Certification** – Updated in April 2010, this publication includes 12 ASTM practices and test methods related to testing fresh and hardened concrete, including those required for ACI grade 1 field-testing and strength testing technician certification. ($42 members, $190 non-members)

3. **2P133 – In-Place Concrete Strength Evaluation: A Recommended Practice** – Revised in July 2011, this Practice contains guidelines for use when strength tests fail to meet specifications. It is based on research by the Association and others and on past experience with strength controversies. The guidelines include investigation procedures, testing methods and precautions, and assignment of responsibility. It addresses the degree of strength deficiency that warrants further evaluation; a sequence of steps to follow in the investigation; and actions that should result from the investigation along with suggestion of allocation of costs. The revisions address current requirements in industry codes and standards. ($12 members, $48 non-members)

Environmental Related Publications

4. **2P159 - Concrete Plant Operators Manual** - This manual is a comprehensive guide for the batch plant operator. It includes valuable information on materials, batch tolerance and aggregate moisture, calculations, plant maintenance, safety and more. ($25 members, $100 non-members)

Promotion Related Publications

5. **2PLCI - LEED Calculator the Concrete Industry** - The Recycled Content and Regional Material Calculator for the Concrete Industry (LEED calculator) is an Excel-based program which calculates the concrete’s contribution to the LEED 2.2 Recycled Content and Regional Material credits. The calculator allows input on project information, concrete producer and other applicable information. The program provides the results in a single page letter which can be provided to the LEED Accredited Professional, project manager or building owner. ($30.00 members, $120.00 non-members)

Safety & Operations Related Publications

6. **2P188 – Truck Mixer Driver’s Manual** – This manual educates truck mixer drivers about concrete and customer relations. This booklet also highlights driver duties, safety precautions, equipment inspection and maintenance procedures, and what the driver should do in case of an accident. *Also available in Spanish – 2P188S;* ($14 members, $54 non-members); (20 or more copies $12 ea. members, $54 ea. non-members.)

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LOCAL:  (301) - 587-1400
TOLL-FREE: 1 (888) 846-7622
WEBSITE: www.nrmca.org

CODES AND SUSTAINABILITY
Colin Lobo Ph.D., P.E. (240) 485-1160
clobo@nrmca.org
Lionel Lemay, P.E., S.E., LEED AP (847) 918-7101
llemay@nrmca.org

COMMUNICATIONS
Frank Cavaliere (240) 485-1141
fcavaliere@nrmca.org

CONCRETE PROMOTION
Glenn Ochsenreiter (240) 485-1140
goehsenreiter@nrmca.org
Jon Hansen (515) 266-1058
jhansen@nrmca.org
Phil Kresge (610) 966-7220
pkresge@nrmca.org
Doug O’Neill, LEED AP (585) 436-8310
doneill@nrmca.org
Vance Pool (281) 557-8415
vpool@nrmca.org
Amy Miller, P.E. (904) 264-8850
amiller@nrmca.org

ENGINEERING
Colin Lobo Ph.D., P.E. (240) 485-1160
clobo@nrmca.org
Lionel Lemay, P.E., S.E., LEED AP (847) 918-7101
llemay@nrmca.org
Karthik Obla, Ph.D., P.E. (240) 485-1163
kobla@nrmca.org

REGULATORY AFFAIRS
Gary Mullings (240) 485-1161
gmullings@nrmca.org

FINANCIAL ACTIVITIES
Michael Olivarri, CPA (240) 485-1130
molivarri@nrmca.org
Nick Muzzatti (240) 485-1131
nmuzzatti@nrmca.org
Tamara Waugh (240) 485-1132
twaugh@nrmca.org

GOVERNMENT AFFAIRS
Kerri Leininger (240) 485-1159
kleininger@nrmca.org
Kevin Walgenbach (240) 485-1157
kwalgenbach@nrmca.org

INDUSTRY RELATIONS
Nico Mahler (240) 485-1158
nmaher@nrmca.org

INFORMATION TECHNOLOGY
Lawrence Afable (240) 485-1167
lafable@nrmca.org
Aaron Laporte (240) 485-1104
alaporte@nrmca.org

MARKETING
Glenn Ochsenreiter (240) 485-1140
goehsenreiter@nrmca.org

MEETINGS
Nico Mahler (240) 485-1158
nmaher@nrmca.org
Jessica Walgenbach (240) 485-1152
jwalgenbach@nrmca.org

MEMBERSHIP
Kathleen Carr-Smith (240) 485-1145
kcarrsmith@nrmca.org
Kimberly Pittmon (240) 485-1146
kpittmon@nrmca.org

OFFICE OF THE PRESIDENT
Robert Garbini, P.E., President (240) 485-1139
rgarbini@nrmca.org
Deana Angelastro (240) 485-1138
dangela@nrmca.org

OPERATIONS/EQUIPMENT MAINTENANCE
Gary Mullings (240) 485-1161
gmullings@nrmca.org

PUBLICATIONS
Jacques Jenkins (240) 485-1165
jjenkins@nrmca.org

RMC RESEARCH & EDUCATION FOUNDATION
Julia Garbini (240) 485-1150
jgarbini@rmc-foundation.org
Jennifer LeFevre (240) 485-1151
jlefevre@rmc-foundation.org

SAFETY
Gary Mullings (240) 485-1161
gmullings@nrmca.org

TRAINING/EDUCATION/CERTIFICATION
Eileen Dickson (240) 485-1164
edickson@nrmca.org
Brian Killingsworth, P.E. (830) 438-2690
bkillingsworth@nrmca.org
Tien Peng, LEED AP, CGP, PMP (206)-913-8535
tpeng@nrmca.org
Amanda Hult (720) 648-0323
ahult@nrmca.org
Shawnita Dickens (240) 485-1154
sdickens@nrmca.org

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FEATURED PRODUCT
NRMCA Introduces 2 New Driver Training Videos

NRMCA’s comprehensive library of training DVDs, including topics from the industry-famous Mentor-Driver Program, support drivers with essential vehicle, product, and professional development information in short, knowledge-packed DVDs that are easily shown in scheduled or informal sessions.

2PRP001DVD - Quality Concrete, The Basics

Because concrete is one of the most durable building materials of all time and because concrete is the most widely used building material in the world, many assume concrete is a simple product. In actuality, it is very complex. This driver training DVD discusses the significant role a mixer driver plays in the outcome of this technical building product. Specifically, it covers the five basic ingredients in concrete, the four types of cement in concrete, and includes an introduction to the seven different categories of admixtures. “Quality Concrete, The Basics” is also suitable for non-technical staff who should have a basic understanding of the components of concrete. Run time - 8 min. 2011 ($70 members, $90 non-members)

2PRP009DVD - Slump & Deliver DVD

Slump and Deliver teaches mixer drivers how to check the slump of concrete before leaving the plant as well as their role on the job site with the customer and a third party technician.

Four key objectives are covered:
1. Defining slump and “over design”
2. The effect of adding water to concrete beyond design specification
3. The correct procedure to measure the slump of fresh concrete
4. How to estimate within ½” the slump of concrete just prior to testing by a qualified, certified technician.

Reduce your company’s chance of a rejected load by training every mixer driver about one of the industry’s most important technical topics. Slump and Deliver is an essential addition to every concrete plant’s training library. Run time - 10:15 min. 2011 ($70 members, $90 non-members)

You can also choose over 80 driver training topics from our extensive library at http://www.nrmca.org/Education/Driver_Education.htm.

These products can be obtained from the NRMCA Bookstore by contacting Jacques Jenkins at jenkins@nrmca.org, or by calling 888-846-7622 x1165.

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- The assets of LAM Industries have been acquired by Midwest Concrete Materials
- WWC, Inc. has purchased selected assets from FNF Construction, Inc.
- The assets of LAM Industries have been acquired by Midwest Concrete Materials
- Mason River Stone Co. has been acquired by Shockey and Tews Brook, Inc.
- The assets of LAM Industries were acquired by Emerson Environmental Group

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Ready Mixed
Concrete Industry Data Report

A benchmarking tool for planning, evaluating and directing the financial activities of your organization

2011 Edition
(2010 data)

Executive Summary
Prepared by
Lydon Fetterolf Corydon, P.A.
Certified Public Accountants
Management Consultants

EXECUTIVE SUMMARY OF RESULTS

This Executive Summary was prepared in consultation with Lydon, Fetterolf, Corydon, P.A. No individual company data was seen by anyone other than employees of Lydon Fetterolf Corydon, P.A. Special thanks to the entire Industry Data Survey Task Group for its work in assisting with the preparation and review of this material. This summary is intended to be a valuable part of the information you receive for your participation in the survey.

The 2011 NRMCA Ready Mixed Concrete Industry Data Report is organized as a set of easily referenced industry performance tables. Most important, these tables help identify trends in overall performance throughout the industry. The tables include the following data aggregations:

- **All Reporting Firms (188 Participants in 2011 Survey)**
- **Upper Quartile (Industry Leaders)** – Defined as the 75th percentile and above for companies with the highest profit before taxes per cubic yard (with the 100th percentile being the most profitable).
- **Lowest Quartile** – Defined as the 25th percentile and above for companies with the highest profit before taxes per cubic yard (with the 100th percentile being the most profitable).
- **Typical NRMCA Member** – Defined as the mean (average) of all ready mixed concrete companies participating in the survey.
- **Respondents by Sales Volume Size:**
  - Under 100 Thousand Yards
  - 100 – 299 Thousand Yards
  - 300 – 500 Thousand Yards
  - Over 500 Thousand Yards
- **Respondents by Geographic Region** (Canadian data converted to $ U.S.)
  - Northeastern/Mid-Atlantic: CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VT, VA, WV, Eastern Canada
  - Southeastern: AL, FL, GA, KY, MS, NC, SC, TN
  - North Central: IA, MN, NE, ND, SD
  - South Central: AR, KS, LA, MO, OK, TX
  - Great Lakes/Midwest: IL, IN, MI, OH, WI
  - Rocky Mountain: CO, NM, UT, WY
  - Pacific Northwest: AK, ID, MT, OR, WA, Western Canada
  - Pacific Southwest: AZ, CA, HI, NV

In using this report to evaluate your own business performance, you should refer to the set of data comparatives that most closely correspond to your own operation. This detailed information should be kept handy and referenced on occasion as a tool for better planning and management control in operating your business.

The charts and tables in this Executive Summary were abstracted from the comprehensive set of statistics. This data represents good overall gauges of industry performance in profitability, expense management, inventory management and other key areas; and while statistically valid based upon random survey methodologies, the numbers are not intended to convey absolutes for industry performance.
OVERALL PROFITABILITY

The ratio “net profit before taxes as a percent of sales” is a good overall measure of company profitability. Essentially, this is return on sales, or an indication of what bottom line profit (return) is being earned on net revenue before taxes. For the typical survey participant, this was -8.1% in 2010 vs. -3.1% in 2009, while industry leaders reported a 4% return in 2010.

Note: Due to automated rounding, some percentages shown in the charts and graphs in this publication differ slightly as compared to those presented in the base report.

PROFIT MODEL

In addition to return on sales, an important component of each NRMCA Ready Mixed Concrete Industry Data Report is a special analysis showing industry profitability based on “return on net worth” (before tax). This single measure essentially summarizes all the key components of profitability: profit management, asset management and financial policy (debt) management.

These charts cover all NRMCA survey participants in the various sales volume and regional categories. These charts are an extremely useful framework in which a company can quickly and easily see which areas of the business need improving. For those companies who participated in the NRMCA Ready Mixed Concrete Industry Data Report, your company’s figures have been calculated and displayed alongside the industry comparatives. The usefulness of these charts is for an individual company wishing to compare its operations with a benchmark or guideline in order to identify possible areas that need improvement.

The easiest way to understand this data is by starting in the middle and working backward. Return on assets is the product of profit and asset turnover. Profit (expressed as a percent of sales) refers to net profit before tax divided by net sales. When asset turnover (net sales divided by total assets) is multiplied by profit, the result is return on assets. Any improvement in your profit or asset turnover will improve the return on assets. Return on net worth is the product of the return on assets and leverage. Leverage is simply an indicator of the degree to which debt is used for financing in the business.

CHART 1
COMPONENTS OF A CUBIC YARD OF CONCRETE - TYPICAL COMPANY VS. UPPER & LOWER QUARTILES
Chart 2: PreTax
Profit as a % of Sales by Company Size 2008 through 2010

Chart 3: PreTax
Profit as a % of Sales by Region 2008 through 2010

Chart 4: Return on Assets (ROA) by Company Size 2008 through 2010
Chart 8: Growth Comparison

Chart 9: U.S. Concrete Production vs. Average Pretax Profit

Chart 10: Average Pretax Profit vs. Average Selling Price
OTHER IMPORTANT MEASURES

Also included in this report are important employee productivity and efficiency management ratios. The tables below highlight some of these indicators by industry sales volume groups and by regions.

TABLE 1: Efficiency Ratios by Company Size 2008 through 2010

TABLE 2: Efficiency Ratios by Region 2008 through 2010