

A Concrete Connection to Highway Quality

The National Ready Mixed Concrete Association Links

Performance-Based Specifications to Customer Satisfaction

By Robert Garbini, President, National Ready Mixed Concrete Association

If you have a stake in highway construction, you've experienced the winds of change sweeping through the business in recent years. We've been propelled closer to our customers, the driving public. We're more tuned into their expectations for high quality roadways that are safe and durable.

Part of the shift in thinking about quality can be credited to the National Partnership for Highway Quality (NPHQ). The National Ready Mixed Concrete Association is a charter member of NPHQ, along with the Federal Highway Administration, the American Association of State Highway and Transportation Officials, The Associated General Contractors of America, the National Institute for Certification in Engineering Technologies, the American Traffic Safety Services Association, and other roadway leaders. NPHQ advocates for quality innovations and practices in the ways our nation's roads are planned, specified, designed, constructed, operated and maintained. It supports the training and certification of a strong, capable workforce. And it keeps the collective eye focused on common goals for the highest possible safety and performance levels.

Pavement Quality and Specifications

The quality of roadways is of particular interest to the ready mixed concrete community, especially as that quality is influenced through the improvement of specifications, training, certifications and practices.

Since there's so much at stake in roadway construction in terms of human resources, quality and safety, the specifications and procedures used for highways, streets, and local roads have spun off to influence the engineering communities in other building segments. Engineers in other disciplines have taken much of what occurs in highway construction and adopted it for other areas. This is also true outside the United States. Engineering practices in other countries are influenced by the practices and specifications of our roadbuilding agencies.

What's the stake for the U.S. ready mixed concrete industry in all this? It's high. The industry manufactures over 400,000,000 cubic yards of concrete per year for roads and bridges and other projects like sidewalks, dams, houses and high rises. That's enough concrete to build twelve coast-to-coast 4-lane highways every year.

Since the founding of NRMCA in 1930, technological advances, production capabilities, and practices of the ready mixed concrete industry for road construction and use in other cast-in-place projects have evolved into a sophisticated science. Unfortunately, the specifications have not. Early specifiers used traditional prescriptive or method specifications for concrete to limit the types and quantities of ingredients, material proportions, aggregate grading and sizing, and more. These prescriptive specifications worked well for a technology-immature industry. But as the industry grew in its skills, the prescriptive specifications have made the process inefficient and stifling to innovation in construction and materials.

Performance-based specifications are the next logical step in the evolution of the concrete construction segment. Performance specifications are directed at what the owner, the user, and the specifier desire to be the ultimate performance. The skilled chemical, material, and process professionals of the ready mixed concrete industry then work with the other members of the construction team to provide a product that will meet those performance criteria. Performance specifications are not a matter of blind acceptance. Certifications and validations are necessary.

It's time for the highway construction industry as well as other segments to capitalize on the skill level of the professionals in the ready mixed concrete industry and the use of performance-based specifications. Philip Crosby, author of "Quality is Free," said it best: "Quality has to be caused, not controlled." In causing higher quality through performance specifications and workforce certifications, transportation agencies and industry can build better, longer-lasting roads with greater value to customers.

Easy to say; hard to do. It's easier to say "This mixture worked for a previous job, so it will work for the next one." It's tougher to meet the broad requirements for concrete construction today; to engineer performance-prediction models and maintenance-cost models; to pinpoint the direct link between key quality characteristics and product performance; to develop a rational basis for adjusting pay when quality is above or below desired levels; and to adapt to local construction conditions. Fortunately, FHWA, the National Cooperative Highway Research Program, AASHTO and other government and industry groups have made solid strides in establishing models for performance-related specifications. Some state departments of transportation have used versions of performance specifications to great effect.

Dedicated industry leaders are working on the issue. One said recently that the transition to every new quality system has three phases: It costs too much; it will never work; and "I thought it was a good idea all along." We're approaching that third phase in the move toward performance specifications!

P2P: Prescription to Performance

NRMCA has a front-burner initiative underway that promotes performance-based specifications. It's called Prescription to Performance, or P2P. Simply put, it supports the voluntary use of concrete construction specifications oriented toward performance. A critical component of the P2P initiative centers on educational and certification programs for production facilities and plants to raise the professionalism and performance level of ready mixed concrete producers as performance-based specifications emerge as the preferred alternative to prescriptive specifications.

These programs clearly coincide with the certification needs of state highway agencies. NRMCA member companies who have certifications that meet the requirements of those agencies should be recognized as having qualified to meet DOT requirements. NRMCA has indicated its willingness to modify existing programs and develop new ones to satisfy DOT requirements as state resources become constrained.

P2P shifts the emphasis from prescribing the ingredients and their proportions in a concrete construction mixture to an emphasis on the performance properties of the combined materials. The details of a concrete mixture in many ways have little meaning to a contractor, design engineer, or the driving public. Concrete producers, on the other hand, are experts. They have to be competent in mixture proportioning to compete, earn positive pay adjustments, and deliver a long-lasting product in a competitive environment.

Even with performance specifications, the ready mixed concrete industry still has to meet certain criteria. The process in which a design engineer specifies “Concrete furnished for this application needs to have this much cement, admixture, water, and aggregate” must evolve for genuine progress in the construction arena. Instead, performance specifications might say “Concrete for this application needs to have a strength of 5,000 psi; chloride ion penetration of less than 1,500 coulombs; and shrinkage limit of 0.06%. A variety of mixture designs could meet the criteria, and the producer has the responsibility and flexibility to design mixtures to accommodate variations in environmental conditions, placement methods, and customer needs.

From the perspective of the contractor and ready mixed concrete producer, performance specifications offer more control, responsibility, competitiveness, opportunities for innovation, and potentially increased profitability. From the customer’s point of view, they’re a welcome focus on performance over the long haul.

There are challenges, of course; one is the shortfall of reliable tests and criteria for some performance attributes. We especially need reliable and precise performance-based tests for concrete durability—corrosion resistance, sulfate resistance, scaling resistance, freeze-thaw resistance, alkali silica reactivity and others.

The development and evaluation of test methods—and the other issues swirling around performance specifications—have arrested the attention of a committed group of volunteers from NRMCA member companies for the past two years. The P2P initiative itself took shape within the NRMCA Research Engineering and Standards Committee with the formation of the P2P Steering Committee in 2002. Co-chaired by Ken Rear of Lehigh Cement Company and Jack Holley of Lafarge North America, the P2P Steering Committee has peeled back the layers on the current system that tends toward prescriptive specifications that dampen incentives for product development, and confines the ability to optimize concrete mixtures for intended performance.

The P2P Steering Committee recently developed a strategic plan with goals that include developing alternatives to current prescriptive provisions; setting minimum standards for quality management at ready mixed concrete production facilities and qualifications of the workforce; and establishing partnerships with architect/engineers and contractors.

Their work sets the stage for agencies, industry, and eventually the driving public to weigh in on performance criteria: a road that lasts a long time, doesn’t need constant repair, and won’t shut down for long when it does need repair. These long-term interests can get lost in the details of prescriptive specifications but are front and center with performance specifications.

Training and Certification

Clearly there’s a level of sophistication essential for the pre-qualification of industry members using performance specifications. And in the short term, not every ready mixed concrete producer or plant will be able to supply concrete for every project involving performance based specifications. But creating a quality management system that ready mixed concrete producers can agree and subscribe to is achievable. The system could include a quality control plan for tests and management of ingredient materials, qualification and certification of personnel, certification of plants, and use of accredited laboratories to develop mixture designs.

NRMCA’s existing certification levels for facilities and personnel are rigorous and respected. They cover plants, trucks, quality control managers, batch plant operators, drivers, sales

professionals and more. The use of performance specifications will mean stepped up training and qualifications for personnel who perform acceptance tests, quality managers, and others who deal with owners, engineers and contractors. Certifications assure customers and regulatory agencies that the holder understands the measures that provide the highest quality ready mixed concrete in safe, efficient ways.

If the industry is to improve, and to launch specifications to the next level, training and certification programs will grow in kind. The P2P Steering Committee is, in fact, looking at the consensus process for developing training and certifications related to performance specifications, with input from stakeholders within and outside the ready mixed concrete industry. It's also considering accelerated means to develop a guide specification.

Into New Territory

Our community is venturing into relatively new terrain with performance-based specifications and associated training, qualifications, and certifications. For the ready mixed concrete industry, the performance-based specs currently in use are generally for high performance concrete, bridge decks, and projects where performance is paramount and mixture designs are cutting edge. They're for projects where we may not really know what the right ingredients should be...but do know that the structure should not deteriorate in the most severe conditions—freezing and thawing, deicing chemicals, and heavy traffic.

As performance specifications become prevalent for more diverse construction projects, accompanied by the appropriate training and certification, the benefits will spin off to the industry, owners, and customers. Bob Templeton, Executive Director of the National Partnership for Highway Quality, notes that “While innovation is often assumed to refer to technical breakthroughs, it is also a way of thinking about quality systems, organizations and practices.”

When we talk about performance specifications, we're talking about a quality mindset and practice: moving beyond method and quality assurance specifications to serving customers over time. Management consultant Peter Drucker called innovation “the act that endows resources with a new capacity to create wealth.” It's also the act that endows resources with a new capacity to exceed expectations and ensure customer satisfaction.