

Prescriptive Specifications

A reality check

by Karthik H. Obla and Colin L. Lobo

About a decade ago, the National Ready Mixed Concrete Association (NRMCA) embarked on an effort to evolve specifications for concrete to be more performance-based. The title *P2P Initiative* was coined to reflect the effort's thrust from prescription to performance. The primary goals were (are) to improve the quality of concrete construction, facilitate the use of concrete mixtures optimized for the functional requirements of different applications, and support innovation and sustainable development. The basic principle of the effort is that specifications should capitalize on the expertise of the concrete producer and the contractor—in the former case, for development of concrete mixtures, and in the latter case, for construction means and methods. Prescriptive specifications that describe the details of concrete mixture parameters are constraints against achieving these objectives. With prescriptive specifications for example, the concrete producer is often held responsible if there is any problem with concrete on a project. This violates a basic principle that responsibility and authority should be congruent.

A working definition of performance requirements for concrete materials is that the concrete meets acceptance criteria when evaluated using standard test methods. The test methods and criteria should be pertinent to the intended performance of the concrete member in the anticipated service condition and for the expected service life. Design and construction also have significant impact on achieving these goals.

The *P2P Initiative* generated many products and outcomes:

- Investigators made a global review of the state of codes and specifications;
- Research documented improved performance with minimized-prescription guide specifications—both by minimizing prescription and suggesting performance alternatives;
- Discussion items were generated for pre-construction meetings between producers and contractors;
- A quality certification program was developed for ready mixed concrete producers; and
- An overview of the impact of prescriptive specifications on sustainability was assessed.

Many of these products are available on the NRMCA website, www.nrmca.org/p2p.

The ACI Strategic Development Council (SDC) recognized the importance of performance-based specifications toward progressing innovation in the concrete industry. In connection with that recognition, ACI established Innovative Task Group (ITG) 8 to develop a document discussing the topic. Subsequently, ACI formed a new committee, ACI Committee 329, Performance Criteria for Ready Mixed Concrete. That committee has published “Report on Performance-Based Requirements for Concrete (ACI 329R-14),”¹ which is based on the ITG 8 report, and it is currently working on a guide to writing a performance-based specification. ACI Committee 318, Structural Concrete Building Code, also developed durability exposure categories that established requirements for concrete as applicable to anticipated exposure in service (ACI 318-08²).

Prescriptive Requirements Common restrictions

In 2014, NRMCA's Research Engineering and Standards (RES) committee decided to conduct a reality check on the impact of the *P2P Initiative*. The intent was to quantify the “state of prescription” in current specifications used for private work. Concrete producer members of NRMCA were provided a list of 15 prescriptive requirements commonly seen in specifications affecting concrete mixtures. They were asked to rate these prescriptive requirements in terms of the frequency that they were seen in specifications; the restrictive effects the requirements had on optimizing mixtures for performance and cost; and the effects the requirements had on performance for the type of placement and application. The list of prescriptive requirements is provided in Table 1, ranked relative to restrictive effect. It was decided to address the top five prescriptive provisions in the ranked list.

Frequency of use in specifications

In the next stage, the NRMCA's RES committee members provided copies of specifications from projects they had worked on in the previous 12 months. About 150 project

specifications were collected. Several were eliminated as duplicates, not having sufficient information, or not being relevant to the evaluation. A total of 102 specifications were then reviewed for the top five prescriptive requirements. The types of specifications reviewed were as follows:

- Commercial buildings—39%;
- Educational/public buildings—23%;
- Public works—18%;
- Environmental structures—14%; and
- Floors—13%.

In some cases, the specification could not be categorized to a type of project. For example, concrete floors were covered in many specifications. While some specifications contained four or five of the listed prescriptive requirements, many had none or only one or two of the top five provisions. It is important to note that when the requirements were consistent with industry standards, such as those stated in ACI 318-11³ or ACI 301-10⁴ and as outlined in Table 2, they were not counted as prescriptive. For example, ACI 318-11 establishes a water-cementitious material ratio (*w/cm*) requirement for

Table 1:
Prescriptive requirements in order of rating (top five considered priority items)

Prescriptive requirements
Invoking maximum <i>w/cm</i> when not applicable
Invoking a minimum content for cementitious materials
Restriction on quantity of supplementary cementitious material (SCM)
Restrictions on characteristics of aggregates, including grading
Restriction on type and characteristics of SCM
Restriction on modifying approved mixtures
Restriction on type and source of aggregates
Requirement to use potable water
Restricting the use of a test record for submittals
Restriction on cement alkali content
Prescriptive requirements for sustainability
Restrictions on type and source of cement
Restriction on use of recycled aggregates and mineral fillers
Restriction on type or brands of admixtures
Prohibiting cement conforming to ASTM C1157 and ASTM C595

Table 2:
Frequency of prescriptive provisions and requirements in industry standards

Prescription	Occurrence in specifications, %	Industry standards
Restriction on SCM quantity	85	Only needed for ACI 318-11 Exposure Class F3
Max <i>w/cm</i> (when not applicable)	73	Only needed when ACI 318-11 durability provisions apply
Minimum cementitious content for floors	46	A test slab alternative is permitted in ACI 301-10
Restriction on SCM type, characteristics	27	None
Restriction on aggregate grading	25	None
Overall average	51	

certain durability exposure classes. In the review of specifications, if a maximum *w/cm* was stated based on these exposure conditions, it was not considered a prescriptive requirement. On the other hand, a provision specifying a maximum *w/cm* for a concrete that would not be subject to any exposure class, such as for an interior column or floor, was considered a prescriptive requirement. The specification review revealed that, although ACI Committee 318 introduced durability provisions based on exposure classes in the 2008 edition of the Code, this assignment for concrete members was seen in less than 5% of the reviewed specifications. Several other prescriptive requirements were noted during the review but not included in the overall assessment.

As indicated in Table 2, an overall “score” for the state of prescription in the reviewed specifications—derived as a simple average of frequency observed—is 51%. It is also observed that a project specification that is written to be consistent with ACI 301-10 would have a prescriptive “score” of 0% based on this assessment.

Specification in Practice Series

With the reality check showing the clear need for additional efforts to move specification writers from prescriptive to performance-based documents, the NRMCA RES committee has developed the *Specification in Practice* (SIP) series. Each SIP document comprises two pages that:

- State a prescriptive requirement;
- Indicate whether the requirement is mandated by industry standards;
- Discuss the basis for the requirement, either real or perceived;
- Describe adverse implications of the requirement;
- Suggest alternative performance criteria; and
- Illuminate the benefits of using the performance requirements in place of the prescriptive requirement.

For now, SIPs covering the top five prescriptive specification items noted in the survey have been completed. They are available in this issue of *CI* (see the Table of Contents) and on the NRMCA website www.nrmca.org/p2p.

References

1. ACI Committee 329, “Report on Performance-Based Requirements for Concrete (ACI 329R-14),” American Concrete Institute, Farmington Hills, MI, 2014, 46 pp.

2. ACI Committee 318, "Building Code Requirements for Structural Concrete (ACI 318-08) and Commentary," American Concrete Institute, Farmington Hills, MI, 2008, 473 pp.

3. ACI Committee 318, "Building Code Requirements for Structural Concrete (ACI 318-11) and Commentary," American Concrete Institute, Farmington Hills, MI, 2011, 503 pp.

4. ACI Committee 301, "Specifications for Structural Concrete (ACI 301-10)," American Concrete Institute, Farmington Hills, MI, 2010, 77 pp.

Selected for reader interest by the editors.



Karthik H. Obla, FACI, is Vice President of Technical Services at NRMCA, Silver Spring, MD. He serves on several ACI committees, including 201, Durability of Concrete; 211, Proportioning Concrete Mixtures; 214, Evaluation of Results of Tests Used to Determine the Strength of Concrete; 232, Fly Ash in Concrete; 236, Material Science of Concrete; 240, Natural Pozzolans; 329, Performance Criteria for Ready Mixed Concrete; 365, Service Life Prediction; 555, Concrete with Recycled Materials; and C601-B, Concrete Quality Technical Manager. He is a winner of ACI's Young Professional Achievement Award and served as President of the San Antonio Chapter – ACI. He received his BS in civil engineering from IIT (BHU), Varanasi, India, and his MS and PhD in civil engineering from the University of Michigan, Ann Arbor, MI. He is a licensed engineer in the state of Maryland.



Colin L. Lobo, FACI, is Senior Vice President of the Engineering Division at NRMCA, Silver Spring, MD. He serves on several ACI committees, including 132, Responsibility in Concrete Construction; 211, Proportioning Concrete Mixtures; 214, Evaluation of Results of Tests Used to Determine the Strength of Concrete; 228, Nondestructive Testing of Concrete; 301, Specifications for Concrete; 318, Structural Concrete Building Code; and 329, Performance Criteria for Ready Mixed Concrete. He received his BE in civil engineering from Mysore University, Karnataka, India; his MS from Northeastern University, Boston, MA; and his PhD from Purdue University, West Lafayette, IN. He is a licensed engineer in the state of Maryland.



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