

Performance Specifications — Why Wait? Act Now!

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Frequently one hears the sentiment that it is hard to implement performance specifications. Two reasons commonly given are: code and specifications do not allow it; there is a lack of test methods to measure performance. Let us look at these reasons a little more closely.

Code and Specifications Do Not Allow It

Chapter 4 (durability requirements) of the ACI 318 Building Code has prescriptive requirements such as w/cm, cement type (only for sulfate resistance), and limitations of dosages of supplementary cementitious materials (only for deicer salt scaling). These requirements are given in Tables 4.2.2, 4.2.3 and 4.3.1 of the Code. *However, the Building Code does not have any prescriptive requirement for minimum cementitious content.* ACI 301 specification has minimum cementitious content requirements (Table 4.2.2.1) for floors, to assure finishability of hard towed surfaces. *Industry standards like ACI 318 and ACI 301 do not establish dosage levels for supplementary cementitious materials (SCMs).* Yet we constantly come across concrete specifications that require specific dosages of SCMs. We also frequently see specifications that require minimum cementitious contents. The intended performance related to these prescriptive limitations is not clear. Imagine how good it would be not to have these prescriptive

requirements. So, why have them then?

Design professionals often indicate that they specify those additional prescriptive requirements for a reason. The reason could be:

1. Minimum cementitious content used as a means to ensure that the w/cm is below a certain specified level. This point can be addressed by asking the engineer to specify the compressive strength commensurate with the desired maximum w/cm that can be documented in the submittal. This is a better way of enforcing that the w/cm is at the desired level rather than requiring a minimum cementitious content. A minimum cementitious content often results in a high paste content, which can lead to adverse concrete performance such as higher shrinkage, higher temperature, creep, cracking and curling.
2. SCM dosage requirements for durability enhancement such as ASR, sulfate attack and chloride permeability. Durability characteristics can be addressed by requiring performance tests in lieu of the prescriptive SCM requirements. The subject of test methods leads to our next reason.

Lack of Test Methods to Measure Performance

At the outset one should realize that test methods will continually evolve and we will

never be at the point where we may be able to test for everything that we would like to at the appropriate precision. Given that it is almost futile to wait to achieve that ideal state for performance specifications, it is possible to use the existing test methods to replace some of the prescriptive requirements. The following test methods are recommended to replace the prescriptive requirements.

The performance limits for each of the test methods and the way that these test methods should be used was discussed in an earlier article*. Thus it can be seen that existing performance test methods can be used in lieu of prescriptive limitations such as SCM dosages.

Summary

Certain prescriptive requirements are required by the Building Code and have to be followed. For the most part these apply to structural concrete. Efforts will continue to modify the Building Code to remove such prescriptive requirements and also address the submittal requirements and establishing appropriate responsibilities.

But it is wrong to say that we cannot make any progress toward performance specifications because the codes and specifications do not allow it. It is entirely possible to stay within the codes and specifications and still remove the additional prescriptive requirements that are very

Property	Common Surrogate Prescriptive Requirement	Performance Test Method
Alkali Silica Reaction	SCM dosages	ASTM C 1567, modified ASTM C 1293
Sulfate Attack	SCM dosages, cement types, w/cm, strength	ASTM C 1012
Chloride Penetration Resistance	SCM dosages, w/cm, strength	ASTM C 1202, AASHTO TP 64, ASTM C 1556
Shrinkage Cracking	Continuous aggregate grading, w/cm	ASTM C 157, restrained shrinkage cracking test

common in construction specifications. Some of the most commonly used prescriptive requirements are minimum cementitious contents and SCM dosage limitations. Both these requirements severely limit the producer's ability to design concrete mixtures that are economical and meet both the owner's and contractor's needs. Existing test methods can be judiciously used to replace these prescriptive requirements.

So, the approach toward a full performance specification is not to wait until the Building Code is changed but to start now by working to reduce the prescriptive requirements in the existing specifications. Consultative discussions by industry personnel with the design professionals are strongly encouraged to change the way we specify concrete mixtures for concrete construction. ■

Reference

* Obla, Karthik, Lobo, Colin and Lemay, Lionel, "Specifying Concrete for Durability - Performance-Based Criteria Offer Best Solutions", *Concrete inFocus*, Winter 2006, Vol. 4, No. 4, pp. 42-50.



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