

Changing the Way Concrete is Ordered in ASTM C 94

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ASTM^{C94}, “Specification for Ready-Mixed Concrete,” was first published in 1935 and is one of the most widely used ASTM documents. While it explicitly is the governing standard for ready mixed concrete, it also serves to clarify items omitted in purchase agreements or project specifications, thereby providing a level of protection to the involved parties. ASTM C94 is clear in Section 1.1 that the purchaser’s requirements govern over the provisions in this standard. While portions of the document have changed to reflect changes in technology, compliance with national codes and even the correction of some technical errors, the document has remained relatively unchanged for decades.

Over the last 10 years, a change has begun to occur within the concrete construction industry. An increase in demand for faster construction, lower costs and the rapid influx of newer technologies have caused many within the industry to move more and more toward performance-based specifications. As related to the material ready mixed concrete, the term “performance-based” is intended to mean a measurable property of the material with associated criteria for acceptability that are understood and agreed

to by the purchaser and the manufacturer without any constraints on the proportions of the mixture. It is further recognized that there are some performance aspects desired by the purchaser that cannot be defined in measurable terms, and in some cases, prescriptive criteria are necessary to satisfy the performance intent based on considerable experience with that parameter. In this context, a performance-based specification for ready mixed concrete does not assure service-life expectations of the owner of the structure. There need to be decisions made by a design professional based on the serviceability expectations of the structure being built that are then translated into measurable concrete properties. Further, there are construction practices that need to happen to ensure that the potential performance as intended by the design professional are realized in the structure. It is also assumed that projects of any significant economic value will and should have a project specification that addresses material and construction aspects pertinent to that project that cannot be covered in ASTM C94.

To foster performance-based specifications, ASTM itself has issued several public statements about migrating current standards and creating numerous new standards focused on performance. Several other code-

writing organizations, such as ACI, have active processes under way to create and migrate toward performance-based codes and standards. Regardless of the potential cost improvement and liability reduction associated with performance-based standards, there are still many participants within the industry who will continue to favor prescriptive-based standards for concrete. As a consequence, any change to ASTM C94 must allow for this market segment as well while still protecting the manufacturer and the purchaser.

Unfortunately, as it exists today, the section of ASTM C94 on ordering concrete fails to explicitly protect either the manufacturer or the purchaser. In the most general sense, there are two direct entities involved in the transaction to purchase and supply concrete: the manufacturer (the entity that batches the concrete and typically delivers it) and the purchaser (the entity that pays the manufacturer for that concrete). There is also an implicit third party that may or may not be the purchaser, and that is the specifier. In some cases, the purchaser and the specifier are the same entity. In the majority of the cases, the specifier provides a specification for concrete construction and the purchaser (contractor) in turn provides the sections pertinent to concrete material to the manufacturer.

However, if you consider the current ordering options under ASTM C94 in “Section 6.0 Ordering Information,” a user of the document is confronted with three choices to order concrete:

Option A: When the purchaser requires the manufacturer to assume full responsibility for the selection of the proportions for the concrete mixture.

Option B: When the purchaser assumes responsibility for the proportioning of the concrete mixture.

Option C: When the purchaser requires the manufacturer to assume responsibility for the selection of the proportions for the concrete mixture with the minimum allowable cement content specified.

The issue is not necessarily with the party that has direct responsibility for the proportions of the concrete mixture, but with the accountability for the actual concrete performance, especially when prescriptive limitations are placed on the proportions. Based

on the ordering methods in Section 6.0, the party accountable for the performance of the concrete may not have been the same party responsible for establishing the proportions. In other words, the manufacturer is going to be held accountable for the performance of a proposed concrete mixture that the manufacturer has little to no control over. By way of example, in looking at all three ordering options, the concrete performance accountability can be summarized in Table 1.

	Concrete Performance Accountability		
	Specifier	Purchaser	Manufacturer
Option A Manufacturer assumes full responsibility for proportions			X
Option B Purchaser assumes full responsibility for proportions			X
Option C Manufacturer assumes full responsibility for proportions, with minimum cement content from purchaser			X

Table 1. Responsibility for performance under the current standard.

As the standard is written currently, all of the accountability for concrete performance rests with the manufacturer, regardless of which option for ordering is used under Section 6.0. However, when comparing this to which party is responsible for establishing mixture proportions, Table 2 presents a different view:

	Responsibility for Mixture Proportions		
	Specifier	Purchaser	Manufacturer
Option A Manufacturer assumes full responsibility for proportions			X
Option B Purchaser assumes full responsibility for proportions	X	X	
Option C Manufacturer assumes full responsibility for proportions, with minimum cement content from purchaser	X	X	X

Table 2. Responsibility for mixture proportions under the current standard.

When looking at Table 1 and Table 2 in conjunction, there is a clear conflict between who is responsible for developing the proportions of the concrete mixture and who is accountable for the actual performance of the concrete.

Currently, the ASTM Subcommittee C09.40 that is responsible for C94 is balloting

revisions to the standard that will provide for only two options for ordering concrete – prescriptive and performance – and defining the associated responsibilities. The proposed changes hope to create very clear and explicit alignment that makes sure that the party that is responsible for the propor-

tions of the concrete mixture is accountable for the performance of the concrete as specified. On the flip side, the party that takes responsibility for establishing proportions of the concrete mixture has to accept the accountability for how the mixture performs. This is outlined in Table 3:

	Responsibility for Mixture Proportions		
	Specifier	Purchaser	Manufacturer
Prescriptive Purchaser assumes full responsibility for proportions	X	X	
Performance Manufacturer assumes full responsibility for proportions			X

Table 3. Responsibility for establishing mixture proportions in proposed change.

Under the prescriptive option of ordering, the purchaser assumes the responsibility for establishing the proportions for the concrete mixture. The manufacturer assumes the responsibility to furnish a mixture that complies with the prescriptive provisions of the order. Conversely, under the performance option of ordering, when the purchaser specifies the performance requirements to the manufacturer; the manufacturer assumes the responsibility for establishing the concrete mixture proportions that comply with the specified performance requirements.

As summarized in Table 4, the accountability for the concrete performance is directly linked to the party that is responsible for establishing the proportions of the concrete mixture.

	Concrete Performance Accountability		
	Specifier	Purchaser	Manufacturer
Prescriptive <i>Purchaser</i> assumes full responsibility for proportions		X	
Performance <i>Manufacturer</i> assumes full responsibility for proportions			X

Table 4. Responsibility for performance under proposed change.

Finally, Table 5 illustrates how the responsibility for establishing mixture proportions and the accountability for concrete performance can be correctly aligned under the proposed ordering system.

	Mixture Proportion Responsibility	Performance Accountability
Option A	Manufacturer	Manufacturer
Option B	Purchaser	Manufacturer
Option C	Purchaser / Manufacturer	Manufacturer
Prescriptive	Purchaser	Purchaser
Performance	Manufacturer	Manufacturer

Table 5. Alignment of mixture proportions responsibility and concrete-performance accountability.

The current Option A does allow for the manufacturer to be responsible and accountable for both actions, which is essentially the performance option. In essence, Option A has been relabeled to become the performance ordering option, and in a sense, is redundant as Option A. The prescriptive ordering option correctly aligns the purchaser’s responsibility and accountability.

While the proposed changes may appear to represent a dramatic shift in appearance to ASTM C94, it actually works to make the document more practical and less cumbersome for the user. The proposed changes create explicit requirements rather than implicit assumptions. The purchaser will still be fully protected, as will be the manufacturer. In fact, the protections will be greater than they currently are because much of the

ambiguity that exists in the current document will be removed.

As part of the proposed change, some examples of performance and prescriptive orders will be suggested in the non-mandatory Appendix of ASTM C94. As indicated earlier, there will be some cases where prescriptive provisions may be necessary either because performance tests do not exist or it takes too long to conduct such tests to establish the performance of a concrete mixture. A case in point is for durability requirements for concrete for exposure classes in the ACI 318-08, “Building Code for Structural Concrete,” intended to provide adequately durable concrete, have primarily prescriptive provisions for concrete. In these cases, the requirements for concrete for the anticipated exposure are based on considerable

experience with these prescriptive parameters to provide the necessary performance, and if the purchaser orders concrete by specifying an exposure class, this could be considered a performance-based order. ■

Szecszy is the incoming chairman of ASTM Subcommittee C09.40. He has been a member of the subcommittee for more than 10 years. In the subcommittee, he has been the task group chair for addressing the use of recycled water that was responsible for establishing the standards: ASTM C1602, Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete, and ASTM C 1603, Test Method for Measurement of Solids in Water. The basis for this article is the rationale being used to support the revisions to the Ordering Information Section of ASTM C94.