

# Contractors, Engineers, and Building Codes: Who is Responsible?

by Kenneth B. Bondy

Recent construction defect lawsuits in Southern California have raised some serious and far-reaching issues relating to the division of responsibility between contractors and design professionals on construction projects. I have an unusual perspective on these issues since I am a structural engineer, and for many years was both a structural engineer and a licensed contractor. In addition, my services are regularly retained as a consultant in many of the actual cases cited. In these lawsuits, contractors and subcontractors are being sued for nonconformance to building code requirements that do not appear in contract documents.

It is my opinion that contractors are not responsible for incorporating building code requirements into their construction work that do not appear explicitly in contract documents. The author believes that design professionals are responsible for including all applicable code requirements in contract documents, and contractors are responsible only to those contract documents and, of course, to standard industry construction practices.

## Background

While the point of this article is not the technical issues in the California lawsuits, it will be useful to know what they are so as to aid in evaluating the profound responsibility issues they raise. The cases involve alleged deficiencies in the design and construction of thousands of concrete slab foundations supporting light single and multifamily wood-framed residences, specifically relating to the sulfate resistance of the concrete. The damage claims in these lawsuits extend into the billions of dollars. Some settlements have been reached; in one case the settlement exceeded the market value of the homes by up to 60 percent (\$640,000 per address where the market value of the homes was about \$400,000).

Soils in many areas of Southern California contain detectable concentrations of water-soluble sulfates. The soluble sulfate content of these soils ranges from negligible to severe, as defined by American Concrete Institute documents. The 1985 Uniform Building Code (UBC) generally adopted the contemporary ACI 318 standard for sulfate durability re-

quirements for reinforced and prestressed concrete. For example, for reinforced or prestressed concrete in contact with "severe" soluble sulfate values, the use of Type V cement and a maximum water-cementitious materials ratio ( $w/cm$ ) of 0.45 is mandated by both ACI 318 and the UBC.

However, for decades (since the mid-60s in my personal experience), California geotechnical and structural engineers have recommended the use of Type V cement for residential concrete foundations in contact with such soils, but have not required any limitation on  $w/cm$  beyond that inherent in the specified concrete compressive strength. Typical concrete used in this type of work has had a specified compressive strength between 2000 and 3000 psi (14 and 21 MPa) with corresponding  $w/cm$  in the range of 0.8 to 0.6, respectively. This local standard practice predated the UBC code requirements by approximately 20 years. Judging from the lack of structural distress that can be related to concrete sulfate deterioration, the local California practice has been successful and appropriately cost effective for the ultimate consumer. Prior to the first of these lawsuits, the author is not aware of a single ground-supported slab ever built in California that contains both Type V cement and a maximum  $w/cm$  less than or equal to 0.45.

In these California cases, the plaintiff has sued not only the developer, but often the design professionals, general contractors, and several levels of subcontractors and material suppliers. Plaintiffs generally allege that: 1. the UBC durability requirements apply to plain concrete foundations supporting light, wood-framed residential construction; and 2. developers, designers, contractors, and suppliers were responsible for and violated those requirements for maximum  $w/cm$ . The contractors are sued on this basis despite the fact that: 1. the explicit limitation on  $w/cm$  for durability did not appear in the contract documents; 2. such a

*Selected for reader interest by the editors. However, the opinions expressed are not necessarily those of the American Concrete Institute. Reader comment is invited.*

limitation on  $w/cm$  is not consistent with long-standing California standard practice; and 3. the specified compressive strength, mix design, and/or the sack content conflicted with the restricted  $w/cm$  and, in fact, established one significantly higher. The contractors, it is alleged, should have known that the building code required a maximum  $w/cm$  for these slabs and are responsible for conformance to code requirements, even if they are not specified by the design professionals in contract documents and even if they conflict with the contract documents.

### Why is responsibility important?

It is obvious why plaintiff attorneys want construction responsibilities defined as broadly as possible. The ability to sue contractors and material suppliers for code violations not contained in contract documents dramatically increases the number of defendants (and the available settlement pool from insurers and the corporate assets of defendants). But is this the way the construction industry has traditionally assigned responsibilities? Does the construction industry as a whole (sophisticated owners, developers, architects, engineers and designers, contractors, subcontractors, materialmen, quality control providers) support the notion that contractors are responsible for code requirements not specified in contract documents? Or are code requirements the sole responsibility of design professionals? Should contractors (or anybody) be sued just because they have insurance or “deep pockets” (assets)?

It is important for the construction community to address these complex responsibility issues and to assert and affirm its own long-standing and established understanding of standard industry practices and construction responsibilities. The assignment of contractor responsibilities in the construction relationship — and specifically, responsibilities beyond those clearly defined in contract documents (if any exist)—must be done on the basis of tradition, logic, and fairness, using some vehicle or document that explains any changes from long-standing practice.

If the industry is not explicit about this, then plaintiff lawyers and trial judges will define the relationships for us. If plaintiff lawyers in construction defect cases define construction practices and responsibilities, it is likely that they will do so in a way that primarily serves their own interests, rather than those of tradition, logic, and fairness. Therefore, it is critically important for the construction industry to reexamine its own practices, to state them clearly, and to make the information available to all interested parties.

### Designer or constructor?

Is a contractor responsible for building code compliance? Many design professionals and contractors would instinc-

tively answer, “yes” — contractors are responsible for building code requirements, whether or not they appear in contract documents. Without a lot of thought, that seems like the right answer. The answer, however, is not that simple and at the very least, deserves much more scrutiny and qualification. For example, is a contractor responsible, say, for this ACI 318-95 code requirement?

*11.4.2.1 – Shear strength  $V_{ci}$  shall be computed by:*

$$V_{ci} = 0.6\sqrt{f'_c} b_w d + V_d + \frac{V_i M_{cr}}{M_{max}}$$

but  $V_{ci}$  need not be taken less than  $1.7\sqrt{f'_c} b_w d$

where

$$M_{cr} = \left(\frac{I}{y_t}\right)(6\sqrt{f'_c} + f_{pe} - f_d)$$

This is a complex code section involving the shear strength of prestressed concrete beams. Obviously, the right answer

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***Does the construction industry as a whole (sophisticated owners, developers, architects, engineers and designers, contractors, subcontractors, materialmen, quality control providers) support the notion that contractors are responsible for code requirements not specified in contract documents?***

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here is no; a contractor is not responsible for this code section, which requires engineering expertise, training, and licensure. Clearly the public interest is not served by making contractors responsible for compliance with this particular code section.

So if contractors are responsible for enforcing the building code, clearly they are not responsible for enforcing all of it. Contractors, who are not licensed design professionals, cannot be held responsible for code requirements requiring engineering expertise and training.

Which parts of the code, then, are contractors responsible for? Where is the dividing line? This concept is rarely addressed since the traditional relationship between contractor and engineer has been well understood by most, at least on a visceral level. Over the years, however, changes in the building codes, which historically had specifically and clearly divided responsibility between contractor and design professional, have now blurred those distinctions and in many instances have made them inconsistent.

ACI’s Committee on Responsibility in Concrete Construction addressed this thorny question when it attempted to identify sections of the ACI Building Code (ACI 318-95) for which the contractor was responsible, and those for which the design professional was responsible. This study was met with much disagreement. Virtually every committee member had a different idea as to who was responsible for what code requirement. Many code requirements are clearly related to design, a few clearly related to construction, but others are in a gray area where responsibility is subjective and depends upon who is doing the evaluation.

## Examples from the ACI Building Code

The current ACI Building Code (ACI 318-95) contains seven parts, as follows:

Part	Title	Chapter
1	General requirements	1-2
2	Standards for tests and materials	3
3	Construction requirements	4-7
4	General requirements	8-12
5	Structural systems or elements	13-19
6	Special considerations	20-21
7	Structural plain concrete	22

Looking only at the titles for the seven code parts, one might easily conclude that Part 3 (that includes just four of the 22 chapters) contains the code requirements for which the contractor may be responsible. However, a review of the four chapters in Part 3 reveals many code requirements involving structural design decisions that must be made by a licensed design professional rather than by a contractor. Look, for example, at Section 6.4.3:

*6.4.3—Construction joints shall be so made and located as not to impair the strength of the structure. Provision shall be made for transfer of shear and other forces through construction joints. See 11.7.9.*

This code requirement appears in Part 3 (Chapter 6), but it is clearly an item that requires engineering judgment and expertise, and for which a design professional must be responsible. In fact, a contractor should not be responsible for such decisions. This code section must be understood by a design professional whose interpretation must then be shown on contract documents for which a contractor has the responsibility of executing. The contractor has no responsibility for analyzing the structure for permissible construction joint locations and shear transfer across those joints. Indeed, if the contractor is not also a licensed engineer, executing such an analysis would be legally prohibited.

The contractor is responsible for building construction joints at the locations specified on the plans, but not for analyzing them to see if they are structurally acceptable. Imagine the absurdity of a contractor taking the responsibility of installing a joint where none was detailed on plans, explaining that it was necessary for the performance of the structure. Such a scenario demonstrates the long-standing and generally unquestioned practical division of duties between builder and designer.

Part 3 also contains requirements that are obviously related only to construction, such as the one that follows:

*7.5.1—Reinforcement, prestressing tendons, and ducts shall be accurately placed and adequately supported before concrete is placed, and shall be secured against displacement within tolerances permitted in 7.5.2.*

This code requirement does not involve engineering decisions, training, or expertise. If contractors are responsible for some code requirements and not for others, then this section would seem to be clearly in the contractor's bag. But consider this requirement:

*5.10.2—Concreting shall be carried on at such a rate that*

*concrete is at all times plastic and flows readily into spaces between reinforcement.*

This is a code requirement that, in my opinion, involves responsibility on the part of both the contractor and the design professional. In addition, the material supplier is involved in the maximum aggregate size of the mix, a parameter also limited by the code. The contractor controls the rate of concreting but the designer specifies the spacing between bars and often approves mix designs. It is interesting to note that if the engineer produces a plan fully satisfying these code requirements, the contractor and material supplier, by conforming to the contract documents, will have conformed to the code without even considering it or being responsible to it.

Finally, let us examine the code requirement that is the focal point of the California sulfate lawsuits. It appears in ACI 318-95, Chapter 4, Section 4.3.1:

*4.3.1—Concrete to be exposed to sulfate-containing solutions or soils shall conform to requirements of Table 4.3.1 or shall be concrete made with a cement that provides sulfate resistance and that has a maximum water-cementitious materials ratio (w/cm) and minimum compressive strength from Table 4.3.1.*

Table 4.3.1 then specifies four categories of sulfate exposure, required cement types and pozzolanic materials, maximum w/cm, and minimum compressive strengths for exposure categories with greater than negligible soluble sulfate contents.

In my opinion, this is a design requirement that involves specialized engineering judgment and training and, if it is to apply to a project, must be stated or specifically referenced in the contract documents. It is simply not reasonable to expect a contractor to have such specialized knowledge.

Traditionally on a California residential project, the geotechnical engineer identifies the level of sulfates present in the soil and recommends the measures required to mitigate them, which may or may not be consistent with Table 4.3.1 depending on the judgment of the design professional, applicability of Table 4.3.1 to the specific project, local standard practice, and possibly other factors. The contractor has no responsibility for enforcing this requirement if the design professionals decide it is not necessary and if the requirement is not normally enforced on other similar projects (as has been the case in California residential foundation work).

So in spite of its title, "Construction Requirements," Part 3 actually contains some design requirements, some construction requirements, some requirements involving both design and construction, and some requirements completely open to subjective interpretation as to responsibility. They are all mixed together, in spite of the fact that they are all in a part of the code with the title, "Construction Requirements." A similar mixture of design and construction requirements appears in the rest of the ACI code, and for that matter, in all published codes.

## Do general building codes clarify responsibilities?

They did until recently. In the past, the model codes themselves have offered sound direction for sorting out the various responsibilities. For example, the 1985 UBC is divided into 11 parts that contain 70 chapters. Chapter 26 titled "Concrete" resides in "Part V—Engineering Regulations—Quality and Design in the Materials of Construction."

The "Scope" section of Chapter 26 explicitly states:

*Sec. 2601. The design of structures in concrete of cast-in-*

place or precast construction, plain, reinforced, or prestressed, shall conform to the rules and principles specified in this chapter.

Since Chapter 26 was based upon ACI 318, it is evident that the writers of the UBC generally regarded ACI 318 as engineering regulations, not construction requirements. By this view, ACI 318 and UBC Chapter 26 serve as governing criteria for the designer to incorporate into the design and the contract documents as necessary and applicable.

The Introduction to the 1995 ACI Building Code (ACI 318-95) reinforces this concept: “Generally, the drawings, specifications, and contract documents should contain all of the necessary requirements to insure compliance with this code.”

From a broader perspective, Part V of the UBC begins with Chapter 23—General Design Requirements and includes chapters on the design of masonry, wood, concrete, steel, and aluminum structures. Chapter 23, serving as the introduction to Part V, begins with its own “Scope” section:

*Sec. 2301. This chapter prescribes general design requirements applicable to all structures regulated by this code.*

These Part V “Scope” references indicate that, “the design...shall conform...” but do not say the “construction,” “installation,” or “the work” shall conform. Certainly, each of the following chapters addressing specific building materials contains some requirements for construction, but in my opinion, these must be incorporated into contract documents by design professionals before they apply to the construction of a specific project. This is consistent with the traditionally held and understood relationship between the engineer and the contractor. Both Part V and Chapters 23 and 26 are for design-related issues and support the premise that designs are regulated by the code, but the work is governed by the plans and specifications and the applicable standard of construction workmanship.

Over time, however, the distinction between designer responsibilities and contractor responsibilities has blurred due to increased scope, detail, and general complexity of design and construction (witness the three volumes that are now required to contain the current 1997 UBC). Therefore, since code requirements are more complex and broad today, and the intent of more recent codes appears to assign duties new to contractors, the assignment of duties between contractors and design professionals must be crystal clear as to which requirement is intended for which entity. Historically, the design section of the general building code has applied only to designers and until the codes become more clear, any ambiguity needs to be addressed by designers (i.e., incorporated into contract documents as necessary and applicable) and ultimately written out of the code. At present, little clarity as to the division of responsibilities exists in currently published building codes.

### **What if the entire code is referenced in the contract?**

Occasionally, sophisticated owners, developers, or design professionals insert a “catch-all” clause into contract documents that attempts to make the contractor responsible for the entire building code. Presumably this is done to cover items not contained in the contract documents, since there would be no necessity for such a clause if all applicable code requirements were in fact contained therein. These clauses

generally look something like this:

*All construction shall be in accordance with the 1994 Uniform Building Code.*

From a contractor’s perspective, these types of statements can have several interpretations, among which are:

1. The contractor is responsible for all requirements of the 1994 Uniform Building Code, including design requirements that do not appear in the contract documents.

2. The contractor is responsible for all construction requirements of the 1994 Uniform Building Code, including construction requirements that do not appear in the contract documents.

The first interpretation, in my opinion, cannot be enforced since it makes the contractor responsible for design requirements that can only be legally executed by a licensed design professional. If the contractor were responsible for design requirements, then all contractors would necessarily have to employ licensed engineers and architects to review the design for code conformance and provide a redesign where even the slightest deviation exists. How many contractors do this in standard construction practice? I know none. Contractors have the right, indeed the obligation, to presume that the design represented in the contract documents is in conformance with all applicable code requirements.

The second interpretation is, in my opinion, not enforceable because of the aforementioned difficulty in deciding which code requirements are construction requirements and which are design requirements. Unless the specific code construction requirements are cited or shown in the contract documents, the contractor cannot be held responsible for them. Once again, the Introduction to ACI 318-95 is helpful:

*“General references requiring compliance with ACI 318 in the job specifications should be avoided since the contractor is rarely in a position to accept responsibility for design details or construction requirements that depend on a detailed knowledge of the design.”*

So catch-all statements inserted into contract documents don’t really accomplish anything, except to confirm that the designer knew his/her design must satisfy the code and also acknowledges the possibility that the design may not comply in some particular way. The ambiguity and subjectivity involved in deciding which code requirements apply to designers and which to contractors cannot be changed by merely attempting to dump the whole code on contractors. The insertion of these catch-all clauses into contract documents is a dereliction of the duties of the design professional, is clearly unfair, and quite possibly a violation of state licensing laws, and in my opinion is not enforceable.

Certainly, specific code requirements can be stated in contract documents — that gives the contractor definitive instruction as to his/her precise responsibilities. But referencing the entire code is neither fair nor reasonable. If the trained design professional is concerned that his/her design may not have addressed the multitudes of possible or potential code requirements, how can he/she in good conscience expect the contractor to meet them, let alone discover or be knowledgeable about them?

### **Standard construction practice**

Regardless of specific code requirements, contractors must conform to standard established construction practices and

the “standard of workmanship” for that trade in the locality where the contractor does business. The standard of workmanship is the whole of the completed work that other competent contractors would build with similar types of work, plans, specifications, and details. A contractor has a responsibility to call attention to a project condition that is substantially different from what he/she is used to seeing in day-to-day business, although the contractor does not have a duty to notice such a discrepancy.

For example, it is not unusual for a concrete contractor to encounter cantilevered slabs on building projects. Reinforcement at the supports of cantilevered slabs is usually placed at the top of the slab, and the experienced concrete contractor should be familiar with common construction practice. This familiarity does not require engineering knowledge or the fact that such placement is related to code requirements, but is merely based on the fact that the experienced contractor normally sees cantilever reinforcing steel placed in such a manner on other projects.

If an experienced contractor encounters a cantilever with the steel detailed on the contract documents at the bottom of the slab, the contractor has a responsibility to alert the design professional of this fact. If the contractor notices that the detail is unusual and does not “blow the whistle” on this condition, then the contractor should share in the cost of repairing the failed cantilever. The responsibility to call attention to an unusual condition does not involve knowing the technical reasons why the condition is wrong (if it is wrong) or the fact that it is a code violation, but merely because it is highly unusual and different from what the contractor has seen in the everyday experience as a concrete contractor.

## Conclusions

There are three possible methods that could be used for assessing a contractor’s responsibility to building code requirements:

1. The contractor is responsible for the entire code, regardless of what is included in the contract documents.
2. The contractor is responsible for all code construction requirements, regardless of what is included in the contract documents.
3. The contractor is not responsible for any code requirements beyond those that appear explicitly in contract documents.

Method 1 is absurd, although I see plaintiff attorneys constantly contending that it applies. Contractors cannot be held responsible for design requirements that require engineering training, expertise, and licenses. It is absurd; if it were true, there would be no need for engineers (except those employed by contractors).

Method 2 is not absurd, but it has little historical precedence (tradition) and it is virtually impossible to enforce because of the ambiguity in current code requirements relating to distinctions between design and construction. If Method 2 applied, contractors would never know precisely what their responsibilities were and contracts would become meaningless. Responsibilities would vary according to whomever was

reading the code. Most concrete contractors with whom I have spoken admit they have never read the concrete sections of the code in total, and many do not even own a copy. At this point in time, the only enforceable, fair, consistent, and logical method for assessing a contractor’s responsibility is Method 3.

Contractors, in my opinion, are only responsible for what is shown on contract documents and for standard construction practices. Contemporary published building codes are ambiguous in the distinction between design and construction requirements and require subjectivity in deciding which is which. Under those circumstances, it is my opinion that design professionals are responsible for including all applicable code requirements in contract documents, and contractors are responsible only to the contract documents and to their requisite standard of workmanship. Contractors have a right to presume that the design contained on the contract documents, prepared by licensed design professionals who are paid for their services, conforms to all applicable code requirements. Similarly, contractors have a legal mandate to avoid the practice of engineering.

The concept of assigning contractors responsibility for code requirements not contained in contract documents cannot be supported by tradition, fairness, logic, or the weight of past editions of various building codes. If the construction industry as a whole decides that, in the future, contractors should bear responsibility for code construction requirements not contained within contract documents, then it must mandate to the code-developing bodies that those requirements be clearly stated as such in the codes. Until that is done, subjectivity will be involved in the division between design requirements and construction requirements, leaving the contractor unaware of his/her precise responsibilities beyond the contract documents. And until then, design professionals are responsible for building codes and contractors are responsible for contract documents and appropriate standards of workmanship.

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