

structural forum

Commentary on "Quality in the Constructed Project"

By William C. Sherman, P.E.

To find information on how to produce a quality engineering project, one might look in ASCE's manual entitled *Quality in the Constructed Project (2000)*. This manual is noted to provide "information and recommendations on principles and procedures that are effective in enhancing the quality of constructed projects." While some facets of quality for engineering projects are included in this manual, in my opinion the following deficiencies exist with respect to "principles and procedures" in quality assurance and quality control (QA/QC) for engineering projects:

1. The article on "Qualifications-Based Selection" does not include the design professional's QA/QC program as one of the selection criteria. Shouldn't this be an essential consideration?

2. The chapter on Agreement for Professional Services makes no mention of QA/QC requirements for the prime professional or for subconsultants. How can the owner be assured that QA/QC procedures will be followed if there is no contractual requirement to do so?

3. The meaning of the important legal term "standard of care" is not addressed in this manual. This term deserves discussion as it is a rather ambiguous term when it comes to QA/QC requirements.

4. The Preliminary Edition of this publication (1988) included a statement that "Disappointment may occur if design cost becomes the primary basis for selecting the design professional." Such concerns are either downplayed or excluded from the current edition, even though such threats to quality still exist.

5. The chapter on Planning and Managing Design makes no mention of design checking, and the chapter on Risk, Liability, and Avoiding Conflict does not discuss the potential benefits of design checking. Many consider detailed checking of design calculations and drawings to be an essential feature of a QA/QC program. A single sentence in the chapter on Quality Assurance and Quality Control mentions "detailed checking of computations". I consider the lack of detail on this important subject to be a serious flaw in this publication.

For 30 years, I have worked on projects that have included detailed checking procedures for

design calculations and drawings. I have rarely encountered a design that did not have some errors - including erroneous assumptions, misapplication of code requirements or design methods, math errors, errors of omission, or detailing errors. I have also reviewed a number of designs by consultants that included errors of the types noted above, but had been sealed by a professional engineer. Where in our industry is there a clear standard to refer to when designs have not been properly checked?

The Preliminary Edition did include "General Guidelines for Establishing a Formal QA/QC Program" that included some information on checking procedures. However, this information appears to have been removed from the subsequent editions... why? Are such procedures no longer considered to be important features of a QA/QC plan? By removing such important information relating to quality, the "quality" of this manual in and of itself is diminished.

I've heard it said that "the three most important ingredients on an engineering project are communication, communication, and communication" - this manual deals extensively with the methods by which the owner, design professional, and constructor communicate. Proper communication certainly enhances quality of an engineering project, but a manual on "quality" should not ignore other significant contributors.

I have in fact discovered written guidelines for engineering quality that address many of the above concerns. The Association of Professional Engineers and Geoscientists of British Columbia (APEGBC) has produced guidelines established to improve the quality of structural engineering in British Columbia, Canada. Their *Guidelines for Structural Engineering Services for Building Projects* require that in-house checks of structural calculations be performed as a standard design procedure, and that "concept reviews" of structural designs be performed by licensees not originally involved in the designs. For designs submitted by a contractor, the Structural Engineer of Record (SER) is required to be the "concept reviewer" of the submitted designs. (www.apeg.bc.ca/)

I would have expected ASCE's manual

on quality to place a strong emphasis on the benefits of such procedures. Unfortunately, the current edition appears to have been edited to be intentionally vague with respect to such procedures - perhaps with the intent to avoid including anything that might be construed as establishing a "standard" that engineering consultants are expected to adhere to. But many in the industry feel that the quality of engineering work has deteriorated in recent years. I would have preferred to have seen ASCE's manual as a driving force to improve quality; however, the current edition may actually be more of a detriment to quality, due to its superficial treatment of the subject. Rather than "raising the bar" with respect to quality, the bar apparently has been set low enough to avoid any real change in how engineering work is performed. ■

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How Do You Define Quality?

A common definition of quality is "meeting the requirements and expectations of the project participants." But this definition may not provide adequate direction to the participants as to what level of quality assurance is needed during design. For design, this definition is often interpreted as "producing sealed drawings within budget and on schedule". However, problems due to lack of design checking may not occur for a number of years after initial construction. How are "expectations" measured when "disappointment" with a design may not become apparent until many years after the design has been completed and paid for? Quality in the constructed project must be measured over the life of the project, not just during the design and construction phases.

Response to William Sherman's Commentary

Quality in the Constructed Project

It appears that Mr. Sherman was looking for (or expecting?) ASCE's publication entitled *Quality in the Constructed Project – A Guide for Owners, Designers and Constructors* (Manual No. 73) to be a detailed treatise, or guideline, on QA/QC procedures, which it is not. In fact, it was never the intent of the Society's Board of Direction, which authorized its development,

Excerpts from "Guidelines For Structural Engineering Services For Building Projects" prepared by the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC):

"The Association supports the proposition that Members should receive fair and adequate compensation for services rendered and that this principle applies to the services provided to comply with these Guidelines. In no event will low fees be justification for services which do not meet the minimum standards set out by these Guidelines."

"In general, structural calculations include but are not limited to: ... Independent check of the final structural design and documents to confirm the adequacy and appropriateness of the design. The independent check shall be performed by an engineer other than the original design engineer, but not necessarily from a separate company."

Excerpts from "Guideline for Professional Structural Concept Review" as prepared by the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC):

"Structural concept review is undertaken by an independent experienced structural engineer to determine if the structural system is sound, the documents appear to be complete, the design parameters are relevant and the structural members are appropriately sized and detailed."

"Many projects incorporate structural components that are designed by specialty engineers retained by the component manufacturer or contractor (e.g. open web steel joists, precast concrete beams, etc.). The Structural Engineer of Record has overall responsibility for coordinating the structural design and shall be the designated structural concept reviewer of designs by specialty engineers."

APEGBC Guidelines and Bylaws are available for viewing at www.apeg.bc.ca.

or the Steering Committee(s) that managed the various phases of its development over the past 20 years, for it to be such a document.

As outlined in the Preface, the Executive Summary and the Introduction (Chapter 1) of the Second Edition, the Manual was written for project owners, design professionals and constructors, as well as other project participants such as the sub-consultants, subcontractors, suppliers and regulatory agencies. *Given its broad intended readership, this Guide is an "aspirational" document with the goal of educating readers and stimulating them to identify areas where they may raise the quality level of their involvement in the design and construction process. This Guide is not a technical standard, nor a compilation of standard industry practices.*

In this context, *quality* [has been] *defined as the fulfillment of project responsibilities in the delivery of products and services in a manner that meets or exceeds the stated requirements and expectations of the owner, design professional, and constructor.*

The content of the *Guide* is the result of reviewing numerous procedural manuals from owners, both public and private, design firms and constructors; the input of hundreds of volunteer writers and reviewers; and comments from hundreds more users, critiques and construction related organizations over the years of development to what it is today. In addition, the current edition provides numerous references to other sources where additional, more detailed information on guidelines and procedures can be obtained.

Our response to the specific deficiencies cited by Mr. Sherman are as follows:

- While the design professional's QA/QC program is not listed in Section 6.2.2 Selection Criteria of Chapter 6: Selecting The Design Professional, there is mention of "Performing design-related quality control functions" under the heading Design Activities in the *Executive Summary* (page xviii), and in Section 20.2 of Chapter 20 Quality Assurance And Quality Control (page 186). There is nothing to prevent the owner from articulating what its own particular selection criteria will be with respect to QA/QC.

- Our response to the comment on Chapter 7: Agreement for Professional Services would be similar. While we make reference to the EJCDC Documents (Engineers Joint Contract Documents Committee) on page 55, there is

nothing to prevent the owner from including a provision on the Designer's QA/QC program in the Agreement.

- There was a conscious decision made at the outset of Guide's development that it would not be a standard, therefore we did not get into the standard of care issue. The legal panel that reviewed both editions of the Guide reinforced this decision.

- We believe there is enough material both in the Guide, and in other source materials from ASCE and other professional societies to make the case for Qualifications Based Selection.

- In the margin of Section 9.1.3, Quality Assurance/Quality Control, of Chapter 9: Planning And Managing Design there is a reference to Chapter 20: Quality Assurance And Quality Control in which there are references to "detailed checking of computations, drawings and quantity take-offs", "review of pay items and specifications", Design Reviews and Audits (Section 20.2.3) and to Chapter 22: Peer Review.

We are aware of numerous examples of the ways in which the Guide has been utilized as a resource, such as:

- A reference text for students enrolled in Civil Engineering courses
- A reference text in training programs/seminars for Resident Engineers and Project Managers
- A reference for new hires that are recent graduates
- A resource for in-house legal counsel in design firms
- A resource for explaining to Owners their roles and responsibilities in the construction process as well as those of the Designer and Constructor

As indicated on page vi of the Second Edition, the concerns and suggestions expressed by Mr. Sherman, as well as any others received by the Society, will be given due consideration when the next update of the *Guide* is undertaken. Until then we encourage its users, both critics and supporters, to add to the dialog on its strengths, weaknesses, general usefulness and needs for improvement. As we have said from the Guide's inception, it is intended to be a living document, or in today's terminology, *a work in progress*.■

Respectfully submitted by the: ASCE
Committee for the Update of Manual 73