Trial Designs

Structural Design Practice Assumptions and Code Interpretation

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Chair of the SEI Design Practices Committee

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Introduction

For several decades, the advancement on the profession through research, computation and analysis has had a profound impact on the practicing structural engineer. This impact can be seen in the increased size of the building codes, standards, guides and manuals. This growth has come at a fast and furious pace. As an example, look at the size of the Uniform Building Code (UBC) during the 1990s. In 1991, the UBC consisted of a single volume printed on 5½" x 8" paper. In 1997, the UBC increased to a three-volume set, printed on 8½" x 11" paper *(see Figure 1)*. This represents a lot of information that practicing structural engineers must absorb in a relatively short amount of time.

Figure 1 = UBC 91 vs. UBS 1997

One of the benefits of membership in the Structural Engineering Institute (SEI) is that it provides a forum for structural engineers to communicate, discuss and interact concerning the advancement and status of the profession. Spurred on by the growth in codes in the later part of the 1990s, this forum for communication and interaction raised questions as to how practicing engineers interprets the codes. The answers to these questions were not immediate or obvious, and thus the Design Practices Committee (DPC) was formed in order to investigate the answers. During the initial investigation another question surfaced…whether engineering judgment is consistent in the profession.

This article provides a brief history of the Design Practices Committee as well as a summary of the DPC's current efforts and future plans. The intent is to make members of SEI, and other structural engineers, aware of the DPC and their important mission.

History

The Structural Engineering Institute's Business and Professional Activities Division formed the Design Practices Committee in August of 1998. The goals of the DPC are to:

- investigate the practicing structural engineer's interpretation of currently-adopted codes,
- investigate the adequacy of design procedures,
- investigate the consistency of engineering judgment in design development,
- promote dialog among practicing engineers and between practicing engineers and code writersand
- provide educational information based on the results of the trail design problems.

It is not the intent of the DPC to solve any issues that may arise, but simply to reveal the issues and facilitate discussion.

To date, investigations into structural engineering design practice have taken the form of "trial design problems." These *trial design problems* are formatted to be "stand alone" problems that have specific topics or focus of investigations. The DPC created the problems, and asked volunteers to complete the problem and submit them to be analyzed. In order to maintain the purity of the investigations, the topics of investigation are not made public during the time of solicited input (solutions) from the practicing engineer at large. It is understood by the DPC that the answers posted to trial design problems are simply one possible solution, and other equally correct solutions may exist.

In 1998, the DPC selected two trial design problems regarding the wind provisions of ASCE 7-95. Results of the trial design problems (published in STRUCTURE, Spring 2000) lead the DPC to conclude

that there was a lack of understanding about some of the provisions in ASCE 7-95, and that even for small buildings the code can be complex. The second problem concerned miscellaneous dead loads, and live loading reductions. The results indicated significant differences in assumptions among the designers.

In 2000, the DPC produced two more trial design problems. One problem looked at ultimate load factors for steel vs. concrete. The results showed reasonable consistency. The second problem involved the design of a concrete shear wall. The results indicated an inconsistent interpretation of the code's seismic design provisions. The inconsistent interpretations were more pronounced for engineers from "non-seismic" areas of the country. The results are published in the Summer 2001 issue of STRUCTURE.

In 2002, the DPC produced three more trial design problems. Each one of these problems investigated the practicing engineer's design approach. Problem #1 concerned development length of reinforcing steel in a concrete joint between a basement wall (soil loading) and a public sidewalk (large live loading). Problem #2 looked at the design approach for the analysis and design of a continuous concrete beam span. Problem #3 involved the approach used to analyze and then design a typical steel column and its related intermediate braces. The results of these trial designs will be available later this year.

Trial Design Problems allow for analysis of how structural engineers interpret code provisions.

The trial design problems have been eye-opening in their initial results, where several of the problems had a very wide range of solutions. The Committee will continue to offer trial design problems in the future. Two more problems are scheduled to be offered this year. The trial design problems will be published in STRUCTURE magazine and the SEI Update. While the trial design problems have given some insight, the response to the problems has been low. It is the intent of the Committee to keep the trial designs to about an hour of effort. We hope by limiting the time commitment, the number of responses will increase. Please note that a structural engineer does not have the answer to the problem. If it is the practice to have non-registered engineers perform a particular calculation under the direction of a structural engineer, the response of that engineer is valid and encouraged.

Current Activities

The Design Practices Committee is currently creating and reviewing trial design problems, and is discussing ways of improving and/or expanding the investigations. To do this, the Committee would like to solicit future trial design problems from the structural community (practitioners and code writers). During the course of structural design, have you ever asked yourself, "I wonder how someone else would interpret, approach or solve this problem?" If you have, please submit your ideas to SEI at **mesaville@asce.org** for the Design Practices Committee to consider for future trial design problems. The input from the structural community at-large is welcomed and desired.

"I wonder how someone else would interpret, approach or solve this problem?"

The DPC and SEI have created a page on the SEI web site where solutions to the trial design problems will be published. This site will also provide a forum for an on-line discussion about the solutions. Go to **www.seinstitute.org**, and click on Announcements to access the site.

The success of this endeavor is wholly dependent on you, the structural engineer. Please take an hour or two to respond to the trial design problems when they are posted. Also be sure to access the new Web site and evaluate the results for yourself.

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