

Coordinated and Complete Construction Documents

CASE's Answer to "Botched Plans"

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In response to ENR's May 2000 article "Botched Plans" about the poor quality of construction documents, CASE charged its Guidelines Committee with finding a solution to the problem. This was not a new problem, as there have been other articles and numerous complaints about the quality of construction documents in general since the mid 1990's.

To help structural engineers address their part of the problem, the CASE Guidelines Committee under the chairmanship of Thomas Wosser, P.E., S.E. prepared *A Guideline Addressing Coordination and Completeness of Structural Construction Documents*. As structural engineers improve their documents, hopefully, the rest of the design profession will follow our lead and follow suit.

The key to achieving the desired level of quality throughout the profession is for each structural engineering firm to focus on and develop its own specific quality management plan, and to implement that plan on each project. This guideline will assist the structural engineering profession in achieving that goal.

As a minimum, the quality goal should not only comply with the applicable code to assure public safety and meet the owners goals of a functional project that is on time and within budget, but also provide documents that are accurate, complete and with sufficient detail to permit competitive bidding and are useable for construction.



Not coordinating the conduit placement with the Electrical Engineer can cause a problem!

This description of quality sounds simple, but involves a lot of work and planning to achieve. Despite the pressures of short schedules and low fees, we must take the time to think ahead, plan and communicate.

"...documents that are accurate, complete and with sufficient detail..."

We must be proactive:

- in securing a decent contract with a clearly defined scope of work,
- by planning up front with the entire design team,
- by making sure that we receive necessary information on time,
- by preparing and following a Quality Management plan.

Responsibilities within the Design Team

For a successful project, these must be defined and understood. In general, the prime professional is responsible for the overall coordination of the project and in the position of having control over the design team. They are responsible for information flow between the team members, for dissemination of information from and to the owner, for setting schedules and managing the project. Although this is how responsibilities are theoretically assigned, many architects or other prime professionals do not effectively manage or coordinate the project. Thus, the structural engineer should take into account the prime professional's ability to manage before accepting a project or setting a fee.

The structural engineer's responsibility must be defined in the Scope of Services section of their contract. The CASE *National Practice Guideline for the Structural Engineer of Record (SER)* provides a good

reference for a scope of services. It is used by many structural engineers across the country in establishing their project services.

Communication

Good communication is essential for developing coordinated documents. Our professional liability insurers report that 75 percent of all claims arise from inadequate communication. The SER must be pro-active with communication throughout the project.

The structural design criteria must be communicated and confirmed at the beginning of the project. These include items such as loads, deflection limitations, fire rating, insurance requirements and code official requirements. This will minimize misunderstanding and rework of design later. A partial Structural Design Criteria Worksheet is included in the guidelines. Each firm should develop a similar, more complete worksheet applicable to their types of projects.

"...minimize misunderstanding and rework of design..."

An important aspect of communication, one that is frequently overlooked, is the development of a schedule for information exchange. It should state when the SER needs items from the design team, and when the design team needs information from the SER.

Coordination

Construction documents must first be coordinated internally within the firm and then externally between disciplines.

We need to prepare organized and clear calculations, coordinate the calculations with the drawings, coordinate drawings and calculations with specifications, and then coordinate the "general notes" with the specifications.

Next, we need to coordinate our drawings and design with the other disciplines. This coordination should include:

- Dimensions
- Tolerances within structure
- Tolerances between structure and finishes
- Geotechnical requirements
- Mechanical/Electrical requirements
- Requirements of Specialty Structural Engineers

Again, it is important to be proactive – Don't wait for others to bring the information to you. Request information and take advantage of team meetings to bring up issues. As an aid to coordination, the Guideline includes a checklist of over 350 items in its Appendix B. This checklist, while relatively complete, is intended as a starting point in establishing your own in-house checklist. The checklist is more beneficial when it is used as a "to do" list rather than a "did I complete" list at the end of the project.

Completeness

Complete structural documents that are well coordinated within themselves and with the other project disciplines provide sufficient information:

- For bids or cost estimates to accurately predict cost and schedule,
- To efficiently produce shop drawings,
- To allow the contractor to build the structure as the SER intended.

In general, complete structural documents will:

- Include clear descriptions of structural elements and their material specifications,
- Be coordinated within and without,
- Show all dimensions necessary for construction and the relationship of structural components to non-structural elements,
- Document the codes and loads used,
- Identify and provide requirements for portions designed by Specialty Structural Engineers,
- Specify the quality assurance requirements.

Dimensions

In general, the SER must provide sufficient information on his drawings to allow preparation of shop drawings and construction of the building's structure. The critical structural dimensions include:

- Overall Building dimensions
- Column grids and spacings
- Location of structural elements relative to grid
- Floor and frame elevations
- Size of all framing members or description of cross section shapes (concrete)
- Structural wall thickness

Typically, the Architect (or other prime professional) provides the building dimensions and elevations and defines the spatial requirements for the structure. Other design consultants also provide dimensions, but these must be coordinated by the Architect.

How do you get these critical dimensions? Ask for them! Ask early and often. Establish a procedure or checklist for the various stages of project development, with prompts to ensure that critical dimensional information is obtained in a timely manner. Document your requests to the prime design professional.

Delivery Systems

With increasing demands for faster project delivery, more often than not we are still designing major portions of the structure while foundations are being constructed. The type of delivery method will have some effect on the requirements and the ability of the SER to provide Coordinated and Complete Construction Documents.

"...construction documents are not complete at the time construction is started."

Design-Bid-Build is the traditional method of construction, and the schedule should allow for fully coordinated and complete construction documents to be issued for bidding.

In the Design-Build delivery method, the design professionals usually (but not always) work directly for the contractor. The contractor sets the design and construction schedules to meet the Owner's requirements. Often this means that all construction documents are not complete at the time construction is started. This requires all parties to understand the constraints involved in designing and building the

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Don't people talk to each other anymore?

structure in advance of the other design professionals.

In addition to Design-Build, there are other "Fast Track" type delivery systems that start construction before the entire building design is completed. This means that critical dimensional information must be fixed and obtained early in the process, while still allowing flexibility for the items to be designed later.

Whenever a system includes some formal Fast Track construction, it is critically important that the Owner understand the risks involved in bidding or constructing a portion of the building before other areas have been completely designed. There will be changes, and the Owner must have money set aside to pay for these changes. Whenever the schedule requires releasing documents prior to completion and final checking, our office places a note on the transmittal form sent with the documents that: 1) these documents are not complete, 2) changes or additions should be expected, and 3) the contractor's estimates and schedule should take this into account.

Quality Management

All firms need to have a procedure or system of quality management that provides for:

- Orderly management of planning and production,
- Establishment of design criteria, calculations, drawings and specifications,
- Review, coordination and checking of construction documents.

This system should be written, and customized for specific projects.

Quality Management has been proven to work. Quality costs less. It is far less expensive to do it right the first time. The time invested in Quality Management will pay real dividends in terms of profit and satisfied clients. Better quality documents mean a better bottom line.

Conclusion

The guideline is not meant to be a "standard of care", but is a resource to assist SERs in preparing a Quality Management System in their firms. Producing Complete and Coordinated documents takes effort, but the firm that provides these documents will:

1. Improve it's reputation and the reputation of SER's
2. Improve efficiency of both design practices and construction
3. Provide better value to clients and owners

4. Be able to demand higher fees by providing better service
5. Be more profitable
6. Have more satisfied clients

Steven E. Schaefer, P.E. is chairman of the CASE Public Relations Committee, treasure of the Structural Engineers Association of Ohio and president of Steven Schaefer Associates, Inc., a structural engineering firm in Cincinnati, Ohio. ■

This new CASE Guideline has sold over 6,000 copies and has sold more than any other publication from ACEC. It is available at online at www.acec.org/publications, enter keyword "coordination". The cost is \$30.00 plus shipping and handling.

CASE Document Top Newsmaker in 2003

The CASE *Coordination and Completion* publication by the National Guidelines Committee chaired by Tom Wosser made ENR's Top 25 Newsmakers of 2003. As reported in ENR's January 12th issue:

"In a move intended to raise quality, the Council of American Structural Engineers has published A Guideline Addressing Coordination and Completeness of Structural Construction Documents. Degenkolb Engineers' Thomas D. Wosser led the two-year effort that produced the 35-page "coping mechanism" intended to help structural engineers get away from the extremes of being the beat-up kid or the belligerent bully. The primer defines and discusses nearly everything an engineer needs to know on the business of a project, including design team responsibilities, delivery systems and quality management..."

ENR, January 12, 2003



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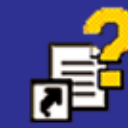
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