Briefing Paper 2

Roles and Responsibilities of Engineers, Architects, and Code Enforcement Officials

Part B: Identification and Resolution of Major Issues

Introduction

This Briefing Paper 2, *Roles and Responsibilities of Engineers, Architects, and Code Enforcement Officials*, addresses the need for improved coordination in the seismic design and construction process, focusing in particular on nonstructural components. Part A provides an overview of why this topic is essential for the reduction of earthquake losses. In particular, it discusses how roles and responsibilities are changing and how these changes can affect quality control and the seismic resistance of specific nonstructural components. This Part B identifies the major issues raised at the 1999 ATC/SEAOC Joint Venture Workshop on Roles and Responsibilities (see Part A for additional information on the workshop) and provides recommendations to resolve three key issues identified at the workshop.

Issues Raised by the 1999 Roles and Responsibilities Workshop

As a starting point for the discussions at the 1999 Workshop on Roles and Responsibilities, six questions were asked.

1. Who should be responsible for ensuring that nonstructural components are properly installed to resist earthquakes?

2. How should the responsibility for nonstructural components be assigned — assigned by whom, and in what form?

3. What should be the responsibility of code enforcement professionals in ensuring the quality of construction of nonstructural components? What should their responsibility be for prescriptive installation standards such as those of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) for mechanical equipment ducts and piping, and those of the National Fire Protection Association (NFPA) for fire sprinklers?

4. What steps can be taken to enable design professionals to be properly compensated for design and for construction observation of nonstructural component installations?

5. How can attention to the quality of seismic resistant construction be increased among design and code enforcement professionals?

6. Is there a similar need to define (or redefine) the roles and irresponsibilities for improving the quality of seismic resistant construction of structural components?

During the workshop, additional issues were also identified, as described below.

A major issue from the design professional perspective is the virtual nonexistence of owner awareness and appreciation of the potential risks and consequences of earthquake damage to both structural and nonstructural components. A general contractor stated that owners are not motivated to be concerned about seismic safety. An unanswered, but important question is: What are the expectations of owners or the public regarding earthquake performance of structural and nonstructural components? Code enforcement officials suggested that designers need to be proactive and educate owners on the benefits of improving quality control. Designers felt that it is difficult to present those arguments without accurate information with which to compare the actual benefits and costs.

Code enforcement officials expressed the belief that public policy makers do not understand or appreciate seismic performance issues and therefore do not give them a high priority. If this is to change, elected officials need education on this subject in simple and very graphic terms. The economic loss consequences of nonstructural component damage, in particular, should be a concern for lenders and insurers, but they too may lack an awareness of the extent and gravity of the problem. Evaluation of earthquake risk and damage potential are often performed by investment trusts purchasing existing buildings. For new construction, however, lenders and insurers apparently assume that the code and its current level of enforcement are entirely adequate. Establishing seismic considerations as a high priority among elected officials, insurers, lenders, owners and the general public appears to be essential in order to create a demand for better quality control for reducing earthquake damage.

Another major issue is that the budget allocated for quality control in most building projects is too small. It is generally believed that owners do not understand that the code is not always fully enforced and they consequently fail to realize that the protections they expect the code to provide, are, in many cases, not being achieved. As a result, requests by designers for fees to cover coordination and oversight of nonstructural component seismic design and installation are often rejected, and in reality, fees are simply not available in most projects. An exception to this occurs in the budgets of hospital and public school construction, because of the rigorous inspection and oversight requirements established and enforced by the state agencies responsible for this construction.

Designers believed that more rigorous code enforcement at the local level in all buildings and all occupancies would help justify the larger fees necessary to coordinate and observe adequately the installation of nonstructural components. Code enforcement representatives concurred that they, too, would need higher fees to provide more thorough inspection of nonstructural component installations. A designer suggested that if local building officials were to require structural observation for seismic anchorage and bracing of nonstructural components, the owner would be forced to allocate a sufficient budget for those services. However, building officials felt that guidelines for deciding when to require such observation would be needed. Obtaining adequate budgets for both code enforcement agencies and designers appears to be a significant issue for achieving adequate seismic performance of nonstructural components.

Some contractors felt that the code is unclear. Workers would do a better job if they received more education on proper installation methods. Coordination between individual trades is critical when attempting to provide adequate bracing or anchorage in tight spaces containing many systems.

A code official remarked that the level of detail provided in many mechanical, plumbing, and electrical schematic drawings is insufficient. An architect admitted that there are significant differences in drawing quality and thoroughness depending on the type of project and its budget, and that there does not appear to be any motivation to improve the quality for the smaller projects. Efforts to delay the production of construction documents or to raise their costs would likely meet strong resistance. Defining a minimum level of detail for installation of nonstructural components for all types of projects appears to be necessary, but the real question is what that level should be.

Three key issues, in the form of questions, evolved from a synthesis of the above cited issues and a vote of the participants (Table 1). Two of these issues evolved from the original questions and their discussion, while the third evolved from subsequent discussion.

Table 1.- Key Issues Identified at 1999 Roles and Responsibilities Workshop (in ranked order)

1. Who should be responsible for ensuring that nonstructural components are properly installed to resist earthquakes, and how should the responsibility for nonstructural components be assigned — assigned by whom, and in what form?
2. Should California building codes require on-site observation of nonstructural installation by design professionals? Who should be responsible for observing seismic bracing of nonstructural components? What level of design professional observation is appropriate?
3. How can clients be educated to care about seismic issues? Who should communicate seismic performance options (including observation) to clients?

Workshop Recommendations

Each of the three key issue questions (Table 1) are discussed separately in the order of priority established by a vote of the workshop participants.

Key Issue 1—Responsibility Assignment:

- Who should be responsible for ensuring that nonstructural components and systems are properly installed to resist earthquakes?

- How should the responsibility for nonstructural components be assigned?
- Assigned by whom?
- In what form?

The answer to the first question was far from unanimous, but the leading candidate for overall responsibility for the nonstructural components was the engineer who designs the building's structural system. Other opinions indicated that the designer or engineer responsible for a specific component should be given this responsibility, or should work together with the building's structural engineer. Another suggested approach was for the nonstructural component designer to hire directly a structural design engineer, who need not be the building's structural engineer. This approach might be more practical when tenant work is under a separate contract. The common thread in each of these is clear; an engineer qualified to design seismic anchorage is always needed. This approach seems to be both practical and legally defensible, because engineers are required by license laws in California to practice only within their scope of expertise, and therefore mechanical and electrical engineers may rightfully believe they should not design seismic anchorage.

The issue of who should *assign* the responsibility is discussed next. It is recognized that any decisions regarding delegation of responsibility for seismic design of nonstructural components must take place at the project management level, with the prime design professional for the project (often, but not always, the architect) making those decisions. Agreement was unanimous that any decision to assign responsibility would also depend on the type and complexity of the project's nonstructural components. Therefore responsibility for nonstructural components would likely need to be tailored to suit a specific project.

The discussions regarding how and in what form the responsibility should be assigned generated a very useful solution. Because the architects present did not believe that the standard AIA contract forms were of any help in this matter, a responsibilities chart was suggested. This was a simple form on which all of the nonstructural components to be installed in a specific project could be listed on one axis, with the other axis listing all of the project's design consultants and contractors. Each component could then be assigned to one (or possibly more than one) of the consultants or contractors, by simply marking a box on the form. Not only would this serve as a simple project management tool, but this information could also be included with a permit submittal so that the plan-check engineer and inspectors would also know who was responsible. A sample of such a form is provided as a Job Aid in the ATC/SEAOC Training Curriculum Notebook (contact ATC for more information).

Key Issue 2—Installation Observation:

- Should California building codes require on-site observation of nonstructural component installation by design professionals?
- Who should be responsible for observing seismic bracing of nonstructural components?
- What level of design professional observation is appropriate?

Providing observation of nonstructural component installation by a design professional was strongly supported by most participants. Observation by the person responsible for designing a seismic restraint system was considered an excellent method to reduce the potential for earthquake damage. Observation of the installation would supplement rather than replace current building department inspections. If this type of observation is not specifically required by law, there will be no budget to implement it as a voluntary recommendation. In the State of Oregon, architects are currently required by the professional license laws to observe certain types of construction.

To implement such a provision as part of the code would require a modification to the current 1998 California Building Code (CBC) that is based on the 1997 UBC. At this time, the only method of modifying the 1998 CBC or 1997 UBC provisions would be by adoption of a code amendment at the local government level. Subsequent to the Northridge earthquake, a few jurisdictions in southern California adopted, and are enforcing, additional structural observation requirements for certain types of elements in a building's structural system. Therefore, such action is not without precedent, but currently it only has been attempted in a limited number of jurisdictions. The other available method to implement observation for nonstructural components is through the code change process developing the International Building Code (IBC), which will replace the UBC in the year 2000. Due to the schedule for publishing the 2000 edition of the IBC, there is no longer, at this writing, 1999, any possibility that such a change could be considered for inclusion in that edition. The earliest time that such a provision could be adopted on a widespread basis would be in the year 2004 or 2005. Although the success of either of these approaches is problematic, it is certainly possible, and worth pursuing if sufficient support for such a code change can be found.

The question of who should perform required observation is not a part of this issue, because it is more closely linked to the responsibility for designing the seismic restraint of nonstructural components. The clear intention is that the person or firm given that responsibility would be the logical choice to make the observations.

The discussion on the necessary level of observation to be provided did not have a complete resolution. It was suggested that providing a level of observation that is just sufficient to supplement the level of local inspection provided would be adequate. That may be a good concept but it could be difficult to define or determine the level of local inspection that occurs, and this could result in significant variations among jurisdictions. A suggestion was made that observation should primarily focus on life-safety situations, such as anchorage of precast cladding elements or other falling hazards, but that it could also include other performance objectives specified by the owner.

The basic problem in defining what constitutes observation is that there is currently no standard in the code on exactly what level of observation is expected, even for those structural observations that are required by the code. This led to a suggestion that a better definition of observation was needed and that guidelines for observation by a design professional definitely need to be developed. It would be impractical and too costly to expect a design professional to observe each and every connection or anchorage.

Key Issue 3—Client Education

- How can we educate clients to care about seismic issues?
- Who should communicate seismic performance options (including observation) to clients?

To convince owners of the value-added aspect of observing seismic construction, including the installation of seismic restraint of nonstructural components, the consequences of damage to buildings must be clearly explained by comparing the potential for damage with and without this observation. This difference may be difficult to quantify but it is possible to compare levels of earthquake damage that have occurred to typical commercial construction with that in hospitals where observation is used. The costs of post-earthquake repairs, the loss-of-use cost, and the potential for very costly litigation or claims for injuries that could result can provide a sound economic argument. In addition, the economics-driven, less-than-complete enforcement of seismic bracing and anchorage requirements must be pointed out to the client.

If this information on the benefits of observation is delivered to owners by the design professional, only during negotiations, it may appear to be simply a method to increase designer fees. On the other hand, if this message comes from lenders and insurers or from business organizations like the Building Owners and Managers Association, it would be much more successful in creating a demand for such observation.

About this Briefing Paper Series

Briefing papers in this series are concise, easy-to-read summary overviews of important issues and topics that facilitate the improvement of earthquake-resistant building design and construction quality.

This briefing paper was prepared by the ATC/SEAOC Joint Venture, a partnership of the Applied Technology Council (ATC) and the Structural Engineers Association of California (SEAOC). Funding for the series was provided by the California Seismic Safety Commission, Proposition 122 Retrofit Practices Improvement Program.

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