ATC-58 Project

Development of Performance-based Seismic Design Guidelines: Phase 1 – Project Initiation

Work Plan

by

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1 Introduction

1.1 Purpose

This Work Plan sets forth the objectives, deliverables, and project management plan for the ATC-58 Project. The Federal Emergency Management Agency has funded this project as the first phase of a planned multi-year program to develop Performance-based Seismic Design Guidelines, following the general approach outlined in *FEMA-349 – Action Plan for Performance Based Seismic Design*. As indicated in FEMA-349, the development of Performance-based Seismic Design Guidelines will require a multi-year effort entailing financial and technical participation from the four NEHRP agencies as well as private industry. As funding levels for this project are not certain at this time, implementation of the FEMA-349 *Action Plan* may require a programmatic effort that extends from 5 to 10 years or more.

1.2 Project Title

The project will be known as ATC-58, Development of Performance-Based Seismic Design Guidelines. The first phase of the project will be known as Phase-1, Project Initiation.

1.3 Background

All building codes and the design procedures contained therein are essentially performance-based. That is, there is a basic intent that if the design procedures and construction requirements contained in the code are followed, buildings capable of providing reasonable levels of protection to the public, against various hazards, will be obtained. Hazards addressed by the codes include fire, disease, wind storm, snow, flood, earthquake, and even the weight of occupancy-related contents. The level of public protection against each hazard that the codes aspire to provide may be described as a *performance goal* or *performance objective*. In the case of fire, for example, performance goals include assuring that occupants can safely exit a building in the event of fire, that the structure will remain stable while fire fighters respond to and combat the fire and that the fire can be contained without spread to adjacent structures. Similar performance objectives exist for all hazards addressed by the codes. For some hazards, the performance objectives are highly qualitative in nature. For other hazards, the performance objectives are stated with precise quantification of the intent, including establishment of a target maximum probability that life loss, or other undesirable behavior may occur.

Although building codes are developed with the intent to assure development of buildings capable of meeting specific performance goals, the development process has been ad hoc and empirical, largely relying on the observation of building performance under extreme events. For example, observation of the ability of fires to jump from the roof of one structure to another led to the requirement for parapets on structures to act as fire barriers between adjacent buildings. Later, it was observed that these parapets had a propensity to fall off of buildings in earthquakes, creating a considerable hazard to pedestrians, and so, additional rules were added requiring that parapets be anchored to the structure, and braced against toppling. As a result, current building codes are a complex compendium of rules. These rules are often highly detailed as to the requirements, for example, a requirement to anchor sill plates of single-story wood-frame buildings to foundations with 5/8" diameter bolts, spaced at 48 inches on center. In other cases, the rules may require a complex series of calculations to be performed, for example, a requirement to design the anchors on a parapet with sufficient strength to resist a specific force, computed based on the parapet's weight, and the intensity of ground shaking predicted for the site. In either case, the rules are highly prescriptive with little direct link between the prescribed requirement and the intended performance. For example, in the case of sill plate anchors, it is unclear what performance would be obtained if the bolts were spaced at 60 inches on center, or if smaller bolts are used. Similarly, it is unclear what performance would be obtained if the parapet anchors provided on a building are either half or twice as strong as prescribed by the code. Designers are often unsure of the basis for the rules contained in the code, the specific poor performance the rule is intended to prevent, or how the rule can be appropriately modified in order to attain other desired performance. The resulting codes are quite complex and often misunderstood and poorly applied, and therefore, sometimes ineffective in achieving the basic intent. Even in those cases in which the code procedures are properly understood and appropriately applied, since they are not rationally based they may be incapable of providing adequate performance. Further, since the prescriptive rules are often quite general, in many cases they may require buildings to incorporate construction features that are not really necessary to achieve the intended performance capability, or that may be inefficient in achieving this performance as compared to other available means. Finally, the default performance objectives the codes intend to achieve may be inappropriate for many buildings and occupancies and there are no clear guidelines on how to adjust the code requirements to alter this performance. In summary, the modern prescriptive building codes are often difficult to apply, occasionally result in needless construction expense, and sometime result in construction incapable of providing the intended performance.

Performance-based design represents an alternative approach to these prescriptive procedures. In performance-based design approaches, the performance objectives and goals are clearly and quantitatively stated at the initiation of the design process. Rather than following specific prescriptive rules, the designer is challenged to demonstrate that a design is capable of meeting the intended performance. This may be done by constructing prototypes and subjecting them to physical tests, such as is commonly done in the aircraft industry, or it may be accomplished through analytical simulation that models the behavior of the building and predicts its performance when subjected to a design event. The building codes and design professions are exploring the application of performance-based approaches to a number of hazards including fire, blast, wind, and earthquake.

Interest in performance-based earthquake engineering first developed under initiatives to mitigate seismic hazards in the existing stock of buildings. Since nearly all existing buildings do not meet current code criteria, yet many existing buildings have demonstrated an ability to survive earthquakes with acceptable levels of damage, lack of compliance with codes for new building construction, by itself, is not a compelling reason to upgrade. Rather, decision-makers are more likely to commit to upgrade buildings when a projection (evaluation) of future earthquake performance has been made that the decision-maker deems unacceptable. Such decision-makers naturally request that buildings be upgraded to provide acceptable performance, which by nature, will vary from decision-maker to decision-maker. In recognition of this, the ATC project team that developed the FEMA-273 Report, *NEHRP Guidelines for Seismic Rehabilitation of Buildings*, developed rudimentary performance-based evaluation and upgrade design procedures that provided the decision-maker and design team with a menu-approach to selection of appropriate performance objectives for individual projects. This approach has been carried forward in the FEMA-356 Report, *Prestandard and Commentary for the Seismic Rehabilitation of Buildings*.

As published in FEMA-273 and FEMA-356, a series of standard performance outcomes, termed performance levels, were established. These performance outcomes related to such things as earthquake-induced building collapse (or collapse avoidance), onset of earthquake-induced building damage that could pose a hazard, and post-earthquake building operability. The decision-maker is asked to select one or more of these performance outcomes, and a ground motion event or hazard level for which this performance is to be achieved. The designer is provided with a procedure that is intended to allow determination as to whether these various performance levels are exceeded, for the selected design hazard. Although the FEMA-273/356 procedures are rational and clearly performance-based, they do have shortcomings. First, the procedures do not directly address control of economic losses, one of the most significant decision-maker concerns. Also, the procedures are focused on assessing the performance of the individual structural and nonstructural components that comprise a building, as opposed to the global performance of the building as a whole. Perhaps most significantly, the reliability of the procedures in delivering the design performance has not been characterized. Many engineers who have applied the procedures believe that they are excessively conservative and that use of the procedures results in unwarranted rehabilitation measures. However, despite this popular belief, because the reliability of the procedures has never been quantitatively and rationally evaluated, it is possible that instead of being too conservative, the procedures do not adequately provide the performance capability expected by the decision makers. It is likely that both outcomes are true for different types of buildings.

Concurrent with the development of performance-based design procedures for seismic rehabilitation, the structural engineering community also became interested in the development of performance-based procedures for design of new construction. This was spurred in part by the large economic losses experienced in the 1989 Loma Prieta earthquake. Although that event caused few life threatening hazards in modern buildings, it resulted in an estimated $7 billion of economic loss. Many judged that these losses were excessively high for a relatively moderate and remotely located event, and that design procedures should be developed that would both permit and encourage the construction of facilities that were less vulnerable to economic loss. These interests were intensified by the $30 billion economic loss that occurred in the 1994 Northridge earthquake. Many observed that although building codes appeared to protect life safety, they did not provide sufficient protection of the public's economic welfare.

In 1993, the Earthquake Engineering Research Center (EERC) at the University of California at Berkeley conducted a project on FEMA's behalf to suggest the requirements for a program to develop performance-based seismic design guidelines for buildings. EERC developed a panel of leading earthquake engineers and structural researchers, invited a series of white papers on important issues, and held a workshop to obtain input from the community on the appropriate parameters for such a program. On this basis, EERC recommended a six-year program of research and development with an estimated implementation cost of $32 million (1995 dollars). These recommendations were published in as the FEMA-283 report, *Performance Based Seismic Design of Buildings*. Prior to funding such a major initiative, FEMA turned to the Earthquake

Engineering Research Institute (EERI) for confirmation that the proposed program was appropriate. EERI followed a process very similar to that undertaken by EERC, though somewhat broader community participation was obtained. The EERI project also culminated in the development of an action plan published in April 2000 as the FEMA-349 report, *Action Plan for Performance-Based Seismic Design*. The FEMA-349 plan extended over an implementation period of ten years and required funding in amounts ranging from $20 to $27 million (1998 dollars).

In the period since the EERC and EERI efforts were undertaken, work towards development of performance-based procedures has continued. In 1994, using funds provided by FEMA in response to the 1994 Northridge earthquake, the Structural Engineers Association of California (SEAOC) undertook a project to develop a framework for performance-based design procedures for new construction. Known as *the Vision 2000 project*, this SEAOC effort extended some of the FEMA-273/356 concepts to new building design and also popularized the concept of performance-based design within the design community. This effort was spurred on by a series of international workshops, as well as efforts in other countries to explore the development of performance-based design approaches. The performance objectives recommended by SEAOC (1995) in the Vision 2000 report, *Performance Based Seismic Engineering of Buildings,* were eventually adopted into the Commentary to the *1997 NEHRP Recommended Provisions for Seismic Regulation for Buildings*, as a means of quantifying the performance intent of the building codes. The Japanese revised their Building Standards Law to encompass many of the recommendations contained in Vision 2000 and some corporations began to request designs using the Vision 2000 approach to performance definitions. Unfortunately, Vision 2000, which was largely based on the technology contained in FEMA-273/356, inherently incorporated the same limitations as these documents.

In response to unanticipated damage sustained by moment-resisting steel frames in the Northridge earthquake, FEMA sponsored the SAC Program to Reduce Seismic Hazards in Steel Moment Frame Buildings. This project developed specific design and rehabilitation criteria for steel moment-frame structures that extended the performance-based design techniques contained in FEMA-273/356. The design recommendations from this six-year, $12 million project were published as the FEMA-350 report, *Recommended Seismic Design Criteria for New Steel Moment-Frame Buildings*, and the FEMA-351 report, *Recommended Seismic Evaluation and Upgrade Criteria for Existing Welded Steel Moment-Frame Buildings*. These recommended design criteria specifically quantified performance in terms of the global behavior of buildings, as well as the behavior of individual components, and also incorporated a formal structural reliability framework to characterize the confidence associated with meeting intended performance goals. Although the FEMA/SAC criteria represent significant technical improvements to the performance-based design approach established in FEMA-273/356, many engineers have stated a belief that these new procedures are excessively complex for routine implementation on projects. Further, the effort required to extend the FEMA/SAC approach to the broader class of structural systems used in modern construction would significantly exceed that proposed in either FEMA-283 or FEMA-349.

The performance based concepts initially developed in FEMA-273 were also adapted for use in three FEMA-funded documents prepared by the Applied Technology Council that provide criteria and methodology for the evaluation and repair of earthquake damaged masonry wall and concrete wall buildings: FEMA-306, *Evaluation of Earthquake Damaged Concrete and Masonry Wall Buildings – Basic Procedures Manual*; FEMA-307, *Evaluation of Earthquake Damaged Concrete and Masonry Wall Buildings – Technical Resources*; and FEMA-308, *Repair of Earthquake Damaged Concrete and Masonry Wall Buildings*. These documents use the analysis procedures provided in FEMA-273 and provide engineering aids for evaluating crack patterns, destructive and nondestructive techniques for damage evaluation, repair techniques, and performance-based policy options.

In 2000, FEMA provided funding to ATC to evaluate and improve the application of inelastic seismic analysis procedures used in FEMA 273/356, FEMA 306, and the ATC-40, Report, *Seismic Evaluation and Retrofit of Concrete Buildings* (ATC, 1996). Specific anticipated outcomes of the project, known as ATC-55, will include: (1) improved understanding of the inherent assumptions and theoretical underpinnings of existing and new procedures; (2) recognition of the applicability, limitations, and reliability of various analysis procedures; (3) guidelines for practicing engineers to apply the procedures to new and existing buildings; and (4) direction for researchers on issues for future improvement of procedures. This activity addresses, in part, some of the issues identified in the FEMA-349 *Action Plan*.

Recently FEMA has also provided funding to ATC to update the *Seismic Considerations Series*, a series of reports prepared by the Building Seismic Safety Council about a decade ago to educate owners of various facility types about seismic-design related issues. Under this new project, known as ATC-56, the Applied Technology Council is developing (1) a brief, glossy brochure to educate buildings owners and manages on the merits of performance-based design concepts, and (2) a technical manual to assist design professionals in understanding and applying performance-based concepts.

In addition to these practice-related efforts, significant research into the seismic performance of structures, and prediction of this performance has occurred at the three National Science Foundation-funded earthquake-engineering centers: the Mid-America Center for Earthquake Engineering Research at the University of Illinois, the Multidisciplinary Center for Earthquake Engineering Research at the State University of New York at Buffalo, and the Pacific Earthquake Engineering Research Center at the University of California at Berkeley. This research has included continued evaluation of structural reliability methods and their application to earthquake performance prediction, prediction of economic losses, development of catalogs of data on the force and deformation behaviors of various types of structures and structural components, and development of more reliable simulation techniques for prediction of performance.

At the same time that these extensive developments occurred in the area of earthquake-engineering the design professions and building code development groups also became interested in extending performance-based concepts to other aspects of design. Notably, extensive development work has been performed in the area of fire protection engineering. Design of buildings for resistance of blast effects, a reintroduction of this Cold War field, have naturally adopted performance-based approaches. Significantly, the International Code Council has recently published and *International Performance Code* and the NFPA-5000 Building Code currently under development also includes extensive performance-based design provisions.

1.4 Technical Approach

The technical approach for this initial project will follow that specified in the FEMA Contract Statement of Work and will therefore focus on the identification and engagement of key personnel, including managers and Steering Committee members, the planning and conduct of two workshops (one for stakeholders and one for technical resource personnel) to assist in defining terminology, setting product priorities and schedules for the overall project, the selection and commencement of an initial product development activity, and the preparation of a project report that describes (1) the work accomplished, and (2) proposed changes to the FEMA-349 *Action Plan for Performance-Based Seismic Design*, including recommended new or revised future tasks that would be needed both to develop and to complete performance-based seismic design guidelines. The technical approach for the multi-year effort will draw heavily on the recommendations put forth in the FEMA-349 *Action Plan for Performance-Based Seismic Design*, which defines six products essential to the creation and implementation of comprehensive, acceptable Performance-Based Seismic Design Guidelines:

1. A *Program Management Plan* that incorporates a broadly based oversight group (the Steering Committee) to shepherd and promote the development of the Guidelines (over an extended period of time, say up to 10 years), and an education and implementation strategy to facilitate the use of the Guidelines.
2. *Structural Performance Products* that quantify performance levels, specify how to evaluate a building's performance capability for a specified level of seismic hazard and with a defined reliability or level of confidence, and provide guidance on how to design a structure to meet a given performance level for a specified level of seismic hazard (with defined reliability).
3. *Nonstructural Performance Products* that provide engineers with the capability to evaluate and design nonstructural components, such as partitions, piping, HVAC equipment (heating, ventilation, and air conditioning), with the goal of ensuring that such components will meet a specified level of performance for a specified level of seismic hazard (with defined reliability).
4. *Risk Management Products* that provide methodologies for calculating the benefits of designing to various performance objectives and to make rational economic choices about the levels of performance desired, the levels of confidence desired, and the comparative costs to reach those levels.
5. *Performance-Based Seismic Design Guidelines* that provide methodology and criteria for design professionals, material suppliers, and equipment manufacturers to implement performance-based design.
6. A *Stakeholders Guide* that explains performance-based seismic design to nontechnical audiences, including building owners, managers, and lending institutions.

Phase 1 of the project will be conducted over an 18-month period, with the assumption that funding for additional project-related work efforts will be provided at the end of the first 12 months.

2 Objectives and Deliverables

2.1 Phase 1 Project Objectives

This Phase 1 project is intended as an initial effort for a long-term program to develop practical and effective performance-based seismic design guidelines, as outlined in *FEMA-349*. Although this project is primarily focused on the development of seismic design guidelines, it is recognized that many of the same principals and concepts developed under this program will be directly applicable to performance-based design for other extreme events, including fire, blast, and severe windstorm. Special care will be taken to coordinate with parallel projects in these other applications areas and to assure compatibility with design considerations for these other hazards. Specific goals of the project are described below.

2.1.1 Establish a Project Management Structure

The project will establish a management team for the effective implementation of the program, throughout its various phases. This management team will include a Project Management Committee (PMC) and a Project Steering Committee (PSC). The PMC will be directly responsible for implementation of the project including development of work plans and associated budgets and schedules, control of work to meet project commitments, retention of project participants, and control of the ultimate quality of the work. The PSC is an advisory committee that will include a diverse group of designers, researchers, regulators, building owners, lenders, insurers and other stakeholders who are interested in the successful development and implementation of performance-based design. This group will serve as an advisory body to the PMC and will provide diverse perspective on key technical issues and conduct of the project. This corresponds to Task 1.1.1 of *FEMA-349*.

2.1.2 Conduct a Workshop on Communication of Earthquake Risk

This Workshop will be used to identify a nuclear group of building owners, building users, regulators, underwriters, financiers, and regulators with a stake and interest in the successful development and implementation of performance-based seismic design, as well as broader applications of performance-based design technologies. These stakeholders will assist the project team in understanding aspects of seismic risk that are important to this stakeholder community, and that should be directly addressed by performance-based design procedures. In addition, this workshop will be used to begin the process of developing a vocabulary for communication of concepts of earthquake loss and risk that are meaningful both to building owners, tenants, and investors as well as to building designers. Finally, this workshop will provide an opportunity to confirm that the concept of performance-based design is relevant to the needs of building owners, tenants and investors as well as designers and regulators. This task may be considered as an initial effort in the performance of Task 1.2 of *FEMA-349*.

2.1.3 Conduct a Performance-Based Design Programming Workshop

This workshop will be used to introduce the ATC-58 program plan to the building design, research and regulation communities, to obtain feedback on significant advances that have occurred since the development of *FEMA-349*, and to assist in identifying appropriate updates to the *FEMA-349* recommendations considering the state of current knowledge. This corresponds to an initial effort to perform task 2.1.1 of *FEMA-349* and will form the basis for development of long range work plans for the ATC-58 project.

2.1.4 Update FEMA-349

Based on input obtained at the two workshops and guidance obtained from the PSC, perform a critical review of the recommended action plan contained in *FEMA-349.* The purpose of this review is to determine if all recommended tasks are still required, to determine if other or alternative tasks are appropriate, to confirm the prioritization of tasks and the adequacy of recommended budgets. Prepare a formal update to the Work Plan contained in *FEMA-349*. This task roughly corresponds to existing Task 2.1.2 of *FEMA-349*.

2.1.5 Initiate Development of First Project Product

Based on input obtained at the two Workshops, initiate an effort to develop recommendations for characterization of performance. This task will consider the performance parameters of significance to stakeholders and users, the need to objectively quantify performance, if it is to be predicted, and the establishment of a vocabulary that is useful both to users and stakeholders. Once established, this performance characterization vocabulary will form the basis for procedures to quantify and predict performance used throughout the balance of the project. This task corresponds to existing Task 2.2.1 of *FEMA-349*.

2.1.6 Develop Project Report

At the conclusion of Phase 1, a Project Report will be prepared to document the work performed during this phase and recommendations for follow-on work.

2.2 Project Deliverables

Project Deliverables are as indicated in Table 2-1 below.

Table 2-1 Project Deliverables

Deliverable	Description	Date Due
Project Management Structure	List of members of the PMC and PSC.	1/30/02
Project Work Plan	Detailed statement of work, management plan, budget and schedule	1/30/02
Earthquake Risk Communication Workshop Proceedings	A report on the proceedings of the Earthquake Risk Communication Workshop including pertinent recommendations from the attendees	6/30/02
Performance-Based Design Programming Workshop Proceedings	A report on the proceedings of the Performance-based Design Programming Workshop including pertinent recommendations from the attendees	12/31/02
Recommended Phase 2 Work Plan	Recommendations for scope of work and budget for the 2nd Project Phase	7/30/02
Update to FEMA-349 Action Plan	An update to FEMA-349 containing a revised and updated task list, recommended budget and schedule	2/28/03
First Work Product Report	A report for the Initial Work Product development task , indicating the preliminary Project Recommendations for Performance Characterization and a Performance Vocabulary	2/28/03
Project Report	A brief report describing the work performed by the project and recommendations for future work.	2/28/03

2.3 Schedule

Phase 1 will be conducted through the execution of five tasks that correspond to the project objectives and deliverables defined above. A Phase 1 project schedule is provided in Figure 2-1.

		MONTHS: 0 3 6 9 12 15 18
Task 1.0:	Develop Phase 1 Work Plan and Manage Project	
Task 1.1:	Form a Project Steering Committee	
Task 1.2:	Plan and Conduct Two Project Development Workshops	W1 W2
Task 1.3:	Initiate First Product Development Activity	
Task 1.4:	Prepare Project Report	
Project Management Committee Meetings		X X X X X X X X X
Steering Committee Meetings		Y Y Y

Figure 2-1. Project Schedule

3 Organization

3.1 General

The Applied Technology Council, under contract to FEMA, has responsibility for the administration and management of the project. A project organization chart is provided in Figure 3-1. The remaining sections identify the various project positions, their roles and responsibilities, and the identified individuals.

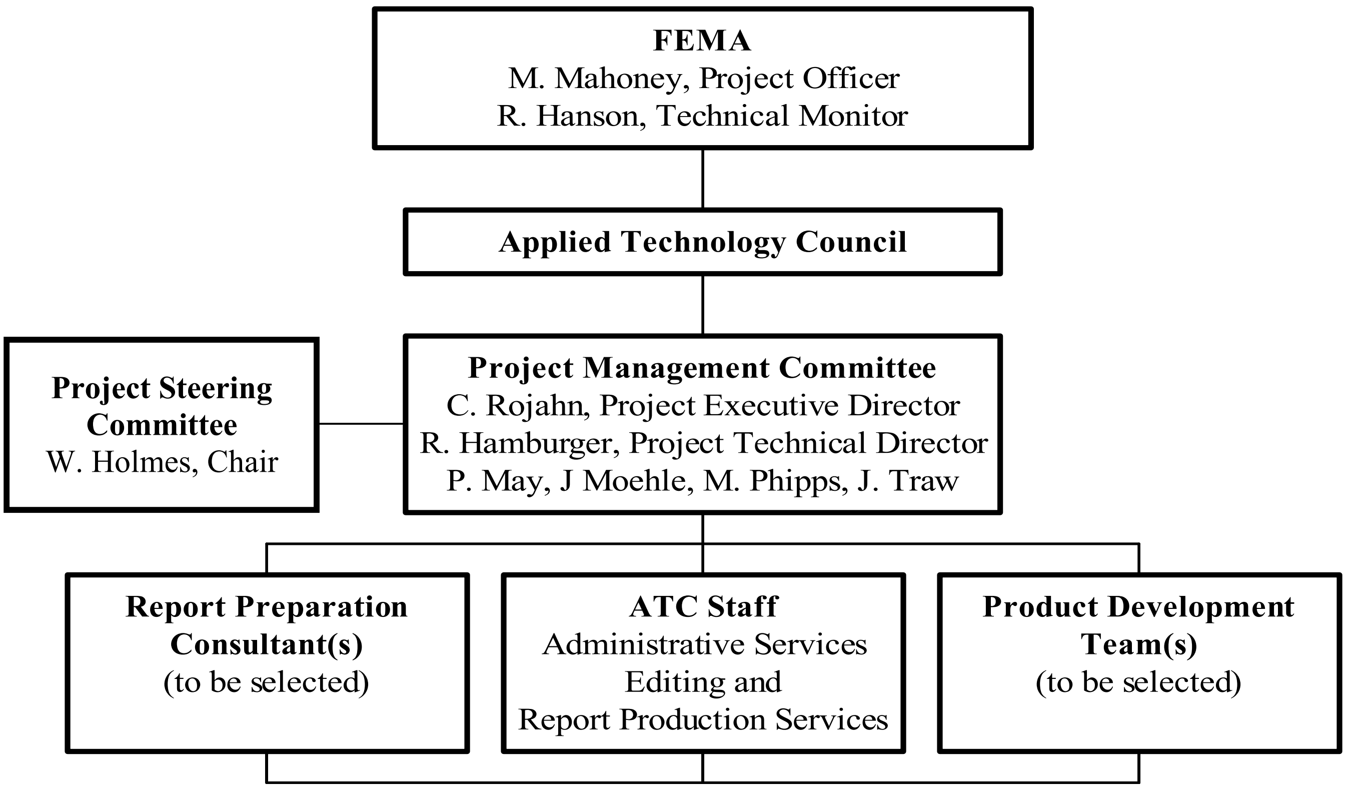

Figure 3-1. Organization Chart.

3.2 Client Oversight and Management

The Federal Emergency Management Agency is the client for this project. FEMA has two direct representatives for this work: (1) the FEMA Project Officer; and (2) the FEMA Technical Monitor. In addition, project deliverables and other contract-required reports are also provided to the FEMA Contracting Officer. The FEMA Project Officer (Michael Mahoney) provides overall project management on behalf of the client organization and is responsible for approval of work plans, work product, budgets and schedules. The FEMA Project Officer will be notified of all project activities and will be afforded the opportunity to attend all project meetings. The FEMA Technical Monitor (Robert Hanson) acts as a technical consultant to the FEMA Project Officer. The FEMA Technical Monitor may perform technical review of all products prepared by the project and will be afforded the opportunity to attend all project meetings.

3.3 ATC Project Management and Organization

Applied Technology Council policy is to operate with a small in-house staff and to utilize the services of highly qualified individuals in diversified areas who serve as consultants, or subcontractors on specific projects. This enables ATC to obtain the services of experts from private practice, the academic community, and government organizations who otherwise would not be available through any one organization.

The project will be organized and managed by a Project Management Committee led by the Project Executive Director and Project Technical Director. Technical overview and guidance for the project will be provided by an advisory Project Steering Committee, consisting of leading available specialists in performance-based design, including researchers, building design professionals, and building regulators, as well as representatives from stakeholder groups that have a direct interest in performance-based design. Detailed project work, including planning of the project workshops, documentation of the workshop findings, and preparation of the final project report will be carried out with the assistance of ATC staff and technical consultants engaged by ATC.

3.3.1 Project Management Committee

The Project Management Committee is responsible for overall management of the technical and administrative aspects of the project, on behalf of the Applied Technology Council. The Project Management Committee is constituted of 6 persons, including the Project Executive Director, who serves as chair, the Project Technical Director, who serves as co-chair, a representative of the ATC Board of Directors, and three at-large members. Management of the project will be performed on a consensual basis with all member of the Project Management Committee provided an opportunity to identify issues, suggest solutions and vote on appropriate courses of action. The PMC will meet at approximately 6-8 week intervals throughout the project, with more intense activity occurring during the active selection of project participants and the production of project products and deliverables.

The Project Executive Director (Christopher Rojahn) has responsibility for overall project management on behalf of ATC, including contract administration and financial management, and serves as the principal interface with the client, including the responsibility for reporting progress on the project. The Project Technical Director (Ronald Hamburger) is responsible for managing the technical progress and conduct of the project with the support and consent of the Project Management Committee. The other members of the Project Management Committee consist of Peter May, Jack Moehle, Maryann Phipps (ATC Board representative), and John Traw.

3.3.2 Project Steering Committee

The Project Steering Committee consists of 13 persons who represent the various stakeholder groups, including building regulation, building development, corporate risk management, commercial lending, property insurance, and the design professions. This group serves as an advisory body to the PMC and provides diverse perspective on key technical issues and conduct of the project, including the making of recommendations pertaining to the identification of needed products, recommending candidates for various project roles, recommending timetables for various activities, and technical and content review of documents produced under the project.

The Project Steering Committee consists of:

- William Holmes (Chair), Rutherford & Chekene, Oakland, California;
- Daniel Abrams, Mid-America Earthquake Center, University of Illinois, Urbana, Illinois;
- Robert Bachman, Consulting Structural Engineer, Sacramento, California;
- Debra Beck, Real Estate Board of New York Inc., New York, New York;
- Randall Berdine, Fannie Mae, Washington, DC;
- Roger Borcherdt, Engineering Seismology, U. S. Geological Survey, Menlo Park, Calif.;
- Michel Bruneau, Multidisciplinary Center for Earthquake Engineering Research, University at Buffalo, New York;
- Mohammed Ettouney, Weidlinger Associates, New York, New York;
- Henry Green, Bureau of Construction Codes, Lansing, Michigan;
- William Petak, School of Policy Planning & Development, University of Southern California, Los Angeles;
- Joe Sanders, Charles Pankow Builders, Altadena, California;
- Randy Schreitmueller, FM Global, Johnston, Rhode Island; and
- Jim Sealy, Architect, Dallas, Texas

The Chair of the Project Steering Committee will work closely with the PMC in determining how the PSC can best monitor the progress of the project and provide meaningful and timely advice to the project team. The Chair will moderate PSC meetings and will coordinate reports of the PSC to the PMC and FEMA as well as other PSC functions.

3.3.3 Project Consultants

Consultants will be selected from time to time throughout the course of the project to perform specific technical tasks. In the first phase of work, project consultants may be retained to perform some or all of the following project tasks, as approved by the PMC:

1. Workshop Consultant – to assist in managing the workshops and producing proceedings
2. FEMA-349 Update Consultant – to assist in preparing the update to FEMA-349
3. Product 1 Consultants – to take the lead in developing the first work product.

4 References

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