CSU Seismic Requirements

Adopted December 8, 2000; revised September 18, 2008

1. CSU SEISMIC POLICY

The California State University (CSU) Board of Trustees adopted the following policy to apply to all CSU construction projects.

> *RESOLVED, by the Trustees of the California State University, that the following policy is adopted:*
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> *It is the policy of the Trustees of the California State University that to the maximum extent feasible by present earthquake engineering practice to acquire, build, maintain, and rehabilitate buildings and other facilities that provide an acceptable level of earthquake safety for students, employees, and the public who occupy these buildings and other facilities at all locations where University operations and activities occur. The standard for new construction is that it meets the life safety and damageability objectives of Title 24 provisions; the standard for existing construction is that it provides reasonable life safety protection, consistent with that for typical new buildings. The California State University shall cause to be performed independent technical peer reviews of the seismic aspects of all construction projects from their design initiation, including both new construction and remodeling, for conformance to good seismic resistant practices consistent with this policy. The feasibility of all construction projects shall include seismic safety implications and shall be determined by weighing the practicality and cost of protective measures against the severity and probability of injury resulting from seismic occurrences. [Approved by the Trustees of California State University at its May 18-19, 1993 meeting (RTCPBG 05-93-13).]*

This policy is the basis for CSU seismic actions. CSU undertook the assessment of the seismic hazard posed by the University's building stock at the direction of Governor Deukmejian in 1992 with resources provided by the Legislature in 1993. Since then CSU has had a vigorous program of reducing the unacceptable seismic hazard of existing buildings and managing current construction programs to limit future seismic risk to acceptable levels.

This document describes the framework necessary to implement the Trustees' Seismic Policy. The objectives and requirements are listed below along with additional background information and a directory to the administrative interpretations of key elements within the policy.

1. *To the maximum extent feasible by present earthquake engineering practice the goal is to acquire, build, maintain, and rehabilitate buildings and other facilities that provide an acceptable level of earthquake safety.*

   Discussion: Actions necessary to accomplish this goal were initiated in 1992 for existing buildings and will continue until all CSU existing buildings meet the seismic safety objective of the Trustees and all new construction meets this goal. Each year capital expenditures are recommended until the unacceptable safety hazard buildings are seismically retrofitted or removed from service. The Seismic Review Board (SRB) is responsible to the Chancellor for review of expected seismic performance characteristics of all CSU buildings and advises the

Chancellor of actions necessary to achieve an acceptable level of seismic risk for CSU buildings. The SRB is addressed in Section 2, and safe use of buildings subjected to possible earthquake damage is addressed in Section 6, and other special issues are addressed in Section 5. Standards for the acquisition and lease of buildings are given in Section 8.

2. *The standard for:*

   - *New construction is that it meets the life safety and damageability objectives of Title 24 provisions:*
   - *Existing construction is that it provides reasonable life safety protection, consistent with that for typical new buildings.*

   Discussion: Title 24 of the California Code of Regulations provides the standards for both new and existing buildings. Title 24 has added provisions for existing buildings since the Trustees' policy was established (Section 3).

3. *Independent technical peer reviews shall be conducted concerning the seismic aspects of all construction projects from their design initiation, including both new construction and remodeling, for conformance to good seismic resistant practices consistent with this policy.*

   Discussion: The SRB is delegated responsibility to conduct independent peer reviews of all CSU construction projects. Conduct of seismic peer reviews is addressed in Section 4.

4. *The feasibility of all construction projects shall include seismic safety implications and shall be determined by weighing practicality and cost of protective measures against the severity and probability of injury resulting from seismic occurrences.*

   Discussion: Title 24 establishes minimum standards for building safety. Section 7 addresses the incorporation of seismic design and review into facilities planning and campus development.

2 SEISMIC REVIEW BOARD

The SRB was established in 1992. It is charged with implementing the independent peer review requirements of the Trustees' seismic policy and also advises CSU on seismic structural engineering issues. Membership is comprised of professionals not otherwise affiliated with the University system. Board members are appointed by, and serve at the discretion of the Chancellor. The Board membership is listed in Attachment A.

The SRB provides peer review of all construction projects undertaken by CSU under this policy as discussed in Section 4.

3 CODES AND STANDARDS APPLICABLE TO CSU CONSTRUCTION ACTIVITY

By law, the California State University is required to enforce the current edition of the California State Building Code (CBC) as adopted by the California Building Standards Commission. CSU by policy has adopted selected sections of Appendix A1 of the California Building Code on administration of code enforcement and interpretation. This applies to both seismic and non-seismic requirements for construction. This code applies to all construction activity undertaken by CSU. Two sections address the seismic design of structures: the requirements for new buildings

are found in Chapter 16; and the requirements for existing buildings are found in Chapter 34.

The CSU Building Official is responsible for enforcement of this code. A Deputy Building Official has been appointed on each campus and has the delegated responsibility under the direction of the Building Official to enforce the code at the associated campus and those additional sites under campus jurisdiction.

When the University constructs and/or modifies facilities subject to regulation by other sections of Title 24, e.g., Historic Building Code, then the appropriate Chapter 16 and Chapter 34 requirements apply. Designated historic structures are subject to the State Historic Building Code, and the same life safety objectives as provided in Chapter 34 shall apply. The SRB will accept all designs developed under the State Historic Building Code following review and approval by the assigned Peer Reviewer.

3.1 Minimum Requirements

The current edition of the California Building Code provides the minimum requirements for the regulation of all California State University construction activity. It applies to all construction, whether it is new, or an addition, modification or alteration of an existing structure.

The seismic requirements of Chapter 34 for existing buildings are less stringent than Chapter 16 for new buildings. The intent of Chapter 34 is retrofit and repair of existing structures that will yield an essential life safety level of performance. Essential life safety means the occupants will be able to exit the structure safely. Chapter 16 may be used for modifications of an existing building if so desired:

The required seismic provisions can be modified by the campus to provide a higher level of seismic performance, but may not be modified to provide a lower level of seismic performance. Chapter A1 allows the Building Official to enforce other provisions as long as they do not diminish the safety of the facility. At any time where the responsible CSU Building Official chooses to exercise the authority of Section 104.2.8, the basis for the modification must be reviewed and approved by the SRB prior to approval of the plans for construction.

Consistent with Chapter 34, the retrofit or repair of a structure to essential life safety as a level of expected structural performance intends that occupants will be able to exit the structure safely following an earthquake. It does not necessarily mean that the occupants will be uninjured or not be in need of medical attention. A structure is presumed to achieve this level of performance where: although significant damage to the structure may have occurred, some margin against total and significant partial structural collapse remains, even though damage may not be economical to repair; major structural elements have not become dislodged or fallen so as to pose a life-safety threat; and, nonstructural systems or elements, which are heavy enough to cause severe injuries either within or outside the building, have not become dislodged so as to pose a life-safety threat. Window glass, roofing tile and elements of non-structural cladding systems are not generally considered to be a falling hazard to be included within this category of concern, except over primary entrances.

3.2 Application to New Buildings

All construction is either new construction or modification of an existing building. Additions to an existing building that are seismically separated from that existing building must meet the requirements for a new building. An addition may be considered seismically separated if the response of its structural elements will not be

directly impacted by those of the existing building, either because they are not physically connected or the physical separation is sufficient to avoid contact during earthquake response. The addition's foundation systems may be in contact if they are at or below grade, and both existing and new foundations have been evaluated to avoid surcharging the other.

3.3 Campus Seismic Coefficients

Chapters 16 and 34 require seismic coefficients for structural calculations. Consistent with Title 24, CSU has adopted minimum seismic parameters (Attachment B) for use on all sites within the contiguous portions of a given campus. The specific site soil conditions are to be determined for the site by the geotechnical engineer as part of the project's development.

For locations not covered in Attachment B, the SRB shall provide such values for design.

3.4 Applications to Existing Buildings

Chapter 34 governs work on existing buildings, and provides a level of life safety generally consistent with that of new buildings, but not particularly to achieve any other function, maintenance, or damage limitation objectives.

Whenever a construction project is planned, Chapter 34 requires, if the triggers are activated (see Section 3415.3), a structural assessment of the seismic performance of the building, and possibly its modification to assure adequate seismic performance of the modified building. Even when no structural modifications are planned, Chapter 34 may require evaluation and modification of the structural system as a part of the construction project. The SRB has determined for some specifically identified buildings that the triggers for Chapter 34 are predetermined to require its application; the lists of such buildings are discussed in Section 7.

Through this regularized assessment procedure, the University can be assured over time that its building stock can be brought up to the standard of performance desired.

Chapter 34 allows use of the resistance capacity of all existing building elements that participate in the seismic response, even when these elements do not meet code requirements for new construction.

Where construction incorporates existing structural elements into the lateral load resisting system of the modified structure, then the provisions of Chapter 34 apply to the complete structure provided that the floor area does not increase by more than 10% and/or that the modifications do not increase the height of the structure. If the net increase in enclosed total floor area is more than 10% of the existing structure's total floor area, then Chapter 16 provisions for new buildings apply to the complete structure. The resistance capacity of the existing elements may be included in the lateral load resisting system using Chapter 34. When the new and existing construction share below grade basement and/or foundation elements only, then Chapter 16 applies to the new structure and it must be verified by rational analysis that loads imposed on the existing structure do not compromise gravity or lateral load performance of the existing structure as determined using the provisions of Chapter 34. The rigidities should be representative of those existing at the maximum seismically-induced deformation.

New and existing lateral resisting elements may be jointly considered to be a part of the lateral resistance system only when the load deformation characteristics of each

of the elements are considered and the loads are apportioned in accordance with their relative rigidities

Any modification, alteration, or addition to an existing building may require that Chapter 34 apply to the construction work. CBC Section 3415.3 defines the project threshold for structures proposed for retrofit, repair, or modification.

Building renovation levels defined in CBC Section 3415.3.1 item 1 are cumulative for alterations occurring after January 1, 1999. Any alteration of a building meeting the threshold requirements of this item 1 must be reviewed to determine if structural modifications are required to meet CBC seismic performance requirements. This requires an evaluation to assess that the building's anticipated seismic performance is adequate, and may require a retrofit of the building. Seismic retrofits are required only when the evaluation determines the building lacks sufficient seismic force resistance to achieve the desired performance level for life safety.

The objective of Chapter 34 is essential life safety. This is achieved by demonstrating that the existing or retrofitted structure can sustain the deformations and corresponding forces induced by the prescribed level of earthquake ground motion. Properly designed structures, meeting 1976 or later editions of the CBC, are not expected to require any significant level of retrofit. Evaluation of post-1976 designs should detect any errors or omissions in the initial design and construction. The evaluation also reviews conditions now in question, that were formerly allowed by earlier editions of the code

The cost basis for Chapter 34 thresholds does not include normal maintenance work: ordinary upkeep and repair work such as replacement in kind, repainting, re-plastering, and re-roofing. Work characterized as normal maintenance but caused by an earthquake is not considered as normal maintenance.

Replacement cost is the construction cost of a like number of assignable square feet of comparable quality designed to house a like program on the same site and built in compliance with codes currently applicable to construction.

3.5 Code Enforcement

The California State University is responsible for enforcement of the CBC. The Chief Architect and Engineer in Capital Planning, Design, and Construction (CPDC) at the Office of the Chancellor is the Building Official for the CSU. By delegation, one person at each campus is a Deputy Building Official for that campus and its other administrative locations. This person is responsible for enforcing the requirements of the California Building Code for all construction at the campus. An assigned CSU Peer Reviewer provides the technical review of the seismic aspects of projects and reports directly to this person (Section 4).

The Chairman of the SRB is designated a CSU Deputy Building Official for special purposes, including post-earthquake evaluation and repair of damaged buildings.

3.6 Active Faults

Faults capable of rupture can traverse campuses where construction is planned. It is recognized that the locations of future fault ruptures are not specifically known, but locations of past ruptures are good indicators of where the fault rupture may occur. The California Geological Survey (CGS) delineates earthquake study zones along known active faults in California. An active earthquake fault is defined as one that has exhibited surface displacement within Holocene time (about 11,000 years) as determined by the CGS under the Alquist-Priolo special studies zones act or other

authoritative source, federal, state or local governmental agency. The purpose of this act is to prohibit the location of new structures for human occupancy across the traces of active faults and to mitigate thereby the hazards associated with fault rupture. Zone boundaries are generally drawn about 500 feet from major faults and 200 to 300 feet away from well-defined minor faults.

State agencies, including CSU, with jurisdiction over sites within an earthquake fault zone must regulate certain development projects within these zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate those sites are not threatened by surface displacement from future faulting. CSU will assume that the fault is active when there is sufficient evidence of an active fault traversing a campus, and it will apply the requirements for investigations pending evaluation by CGS of its status. The SRB determines the sufficient level of evidence regarding possible fault zones and maintains maps of zones determined to warrant treatment as a fault hazard zone.

When an active fault traverses a campus within a defined seismic zone as determined by CGS or by the SRB for the subject fault:

> *All planned construction within the Earthquake Fault Zone shall have detailed geologic studies of the building site to determine if a fault trace passes through, or is within 50 feet, of the building perimeter. Such studies shall be completed under the peer review requirements of Section 4.*

The distance from a building to a fault is measured from the closest point of the building, including its foundation, to the fault along a line normal to the plane of the fault. No new building shall be constructed or existing building's envelope extended where the closest portion of the building, including foundations, is less than 50-feet from an active fault. Where the geological assessment is determined to support a smaller value than 50-feet, the SRB can approve the value on a case-by-case basis.

The SRB must approve selection of the engineer of a site study within a seismic zone prior to the initiation of the investigation. Once a geological study is completed, and the peer reviewer accepts the results, this study will provide a basis for design of the subject building for no more than five years after acceptance of the report by the peer reviewer, or a new study must be completed to determine findings for the site consistent with current scientific and field investigations.

Within an Earthquake Fault Zone, Chapter 34 applies wherever the structure is to be modified without regard to its extent or purpose, notwithstanding the allowances of Section 3415.3.

The SRB shall evaluate the hazard posed by fault rupture to all existing buildings within an Earthquake Fault Zone and include this hazard in their overall evaluation of the seismic risk of the building.

No new building shall be constructed or existing building's envelope extended where the closest portion of the building, including foundations, is less than 50 feet from a fault within an Earthquake Fault Zone.

Where a portion of the building is removed as a part of the building modifications, then the new perimeter of the modified building shall be used to determine if these conditions are met.

These procedures apply only to buildings that are occupied, and not to storage buildings that are not occupied by staff except for the purpose of placement or removal of stored materials; buildings where maintenance functions or other work are performed do not qualify for this exemption. Under no circumstances should

such buildings house chemical or hazardous substances that, if released, could pose a toxic threat to the area around the building.

3.7 Peer Review for Small Projects

By Trustee policy, every campus construction project requires seismic peer review. For some projects the campus may believe there are no structural issues requiring seismic peer review. In such cases the campus should submit to the peer reviewer the particular work to be performed for a review without issuing a work order for the project.

There are no costs to the campus for this type review determination. The costs are included in the Chancellor's Office master agreement with the peer reviewer. If the peer reviewer determines a peer review is required, then the normal process described above shall be used. For minor capital expenditures, repair and maintenance projects the Campus Deputy Building Official may complete the peer review process internally and document compliance with these requirements or submit it to the seismic peer reviewer for consideration.

3.8 Peer Review Verification

All approved plans for construction shall have a stamp to verify the design is in compliance with appropriate CSU Seismic requirements. The stamp shall indicate that new projects have been reviewed consistent with Chapter 16; that renovation projects have been reviewed consistent with Chapter 34 and are either compliant, below all application thresholds, or are waived for specific reasons. The peer reviewer's stamp shall be placed on the first sheet of the record set of Construction Documents (with the other agency approvals), and be signed and dated by the Seismic Peer Reviewer.

3.9 Engineer-of-Record (EOR)

All aspects of the structural design of a CSU project shall be under the responsible charge of **one** licensed California Architect, Civil Engineer, or Structural Engineer that serves as the Engineer-of-Record (EOR) for the project through completion of construction. The Engineer-of-Record shall be determined at the beginning of the design process and may not be changed in the course of construction without approval by CSU. The structural design includes the design of the structural frame, lateral force-resisting system, foundations, structural aspects of the building skin/façade; and support and anchorage of equipment, building systems and architectural features. The EOR has responsibility for the structural aspects of the entire project and must sign and stamp all final documents, including deferred submittals, for which he/she is in responsible charge.

3.10 Special Inspections

Chapter 17 of the California Building Code (CBC) requires the design professional to prepare special inspection and testing requirements for a proposed project, the Owner to confirm responsibility for their completion, and the Building Official to approve the proposed plan. The materials sections of the Code and many referenced standards therein, e.g. AISC Seismic Requirements, Table Q, make additional requirements for inspection that must also be considered in the development of the testing and inspection program for construction. The Chancellor's Office maintains model forms that can be used as the basis for preparing the required Special

Inspections Program. Where there are deferred approvals items, the special inspection requirements specific to the deferred work must be prepared and submitted with the design documents for each deferred item.

4. PEER REVIEW

Peer review is a mandatory part of the construction process of the California State University system.

Peer review is to be performed for all building projects and for all engineered structures, such as trailers and bridges. Other construction activities may be referred for seismic peer review at the discretion of the Building Official or Deputy Building Official. If the peer reviewer concludes that a seismic peer review is not required, then a letter to this effect will be issued. This letter is an adequate record of peer review of the project, provided the scope of the project does not change.

The purpose of peer review is to assure project quality, to provide a measure of additional assurance regarding performance and safety of the completed project, to provide advice on methods and means, and to provide relevant specific campus information. When the peer review of the design has been completed, but aspects of the design are not complete because of deferred submittals, discovered conditions, etc., then these should be identified in the review documentation and reviewed during the construction period when identified by the EOR's evaluation as having implications for the seismic performance.

Peer review is not intended to and does not replace the design responsibilities of the Engineer-of-Record. Peer Review is not a plan check for detailed determination of the compliance of the developed plans to requirements of applicable codes and standards.

Peer review is an objective technical review by an independent, knowledgeable reviewer(s) experienced in structural design, analysis, and performance issues. The reviewer(s) shall examine the available information on the condition of the building, the basic engineering concepts employed, and the recommendations for action.

The SRB has assigned individual peer reviewers for each campus (Attachment C). The SRB assigns Peer Reviewers for locations not listed in Attachment C as needed. The SRB establishes policies and procedures for Peer Review. The Peer Reviewer is responsible and accountable solely to the SRB, the CSU Chancellor and CSU Trustees for their actions.

The principal peer reviewer may assign one or more qualified individuals to provide independent review under their direction. The SRB will periodically review such assignments.

A peer reviewer performs a different service than an organization's internal technical review, a Building Official's plan review, or a third party plan check review. The peer review provides the Engineer-of-Record (EOR) with a qualified technical opinion, on the adequacy of the structural engineering approaches used and the resulting design. The peer review is not intended to check the project for code compliance, or to validate computations, or conduct detailed examination of the retrofit design. Any such actions by the peer reviewer will be limited to those deemed required to complete his responsibilities. Because the peer reviewer is responsible to review the expected seismic performance characteristics of the buildings, in light of the Trustees' Seismic Policy and specific CSU policies adopted to achieve this purpose, the review may exceed minimum building code requirements in assessing performance of the overall structural system(s). The peer reviewer does advise the

Deputy Building Official on seismic related code compliance issues, but the Building Official retains the responsibility and authority for code compliance.

A peer review is not the same as value engineering but may include elements of value engineering. The purpose of value engineering is to suggest alternative systems, materials, and methods for a project to reduce its cost. The purpose of the peer review is to assure that the seismic response characteristics of the building are well considered, appropriate, and acceptable.

4.1 Scope of Review

Documents for review shall include available construction documents, observations of the condition of the structure, all inspection and testing reports (including methods of sampling) analyses prepared by the EOR and consultants, and the retrofit or repair design. Project review is both site- and building-specific, and considers proximity to faults, and soils and geologic conditions. The expected seismic performance characteristics for each building includes the geometry of the building, the structural system(s) proposed, lateral and gravity load paths; and whether these are supported by design, calculations, and detailing in the project documents. Review shall include consideration of the proposed design approach, methods, materials, and details.

Peer review tasks include any or all of the following:

- Assess appropriateness of analysis and ensure a high quality design;
- Suggest additional design options, analysis perspectives, and provide knowledge of experience in materials performance considerations;
- Provide constructive comments on work in progress;
- Assist in achieving consistency of design and design approach among different CSU projects and in expected retrofit project seismic performance;
- Aid in communication regarding local conditions;
- Provide technical assistance for resolution of technical problems encountered in the design and construction;
- Communicate with SRB on technical issues and concerns with system wide implications;
- Offer positive engineering input where new, and/or innovative design or analysis procedures are proposed.

The EOR for the project and CSU campus project manager shall provide to the peer reviewer all available information determined by the peer reviewer to be necessary for the completion of the peer review.

The effort undertaken in peer review is commensurate with the size and complexity, or lack thereof, of the project, but shall not be limited so as to compromise the technical reliability of the process.

4.2 Timing of Peer Review

The peer reviewer will be engaged for the entire project, from concept to final construction, and should participate during early structural design to ensure concurrence with systems proposed for the specific project. The peer review is completed when the construction is completed.

Where the delivery method is design-build, the peer reviewer's effort begins when the Request for Proposals (RFP) is prepared, see Section 5.

4.3 Reports

The peer reviewer(s) shall prepare a written report to CSU and the responsible Deputy Building Official describing all aspects of the review performed, including conclusions reached by the reviewer. Reports shall be issued, as appropriate, after conceptual design, schematic design, during design development, and at completion of construction documents, but prior to their issuance for permit. On phased projects, a report shall be issued after completion of each phase. Such reports should include, at the minimum, statements of the following:

- Scope of engineering design peer review with limitations defined.
- Status of the project documents at each review stage.
- Design, performance and loading criteria.
- Ability of selected materials and framing systems to meet performance criteria with given loads and configuration.
- Degree of structural system redundancy and the deformation compatibility among structural and nonstructural elements.
- Basic constructability of the retrofit or repair system.
- Other recommendations as appropriate to the specific project.
- Presentation of the reviewer's conclusions identifying any areas needing further review, investigation and/or clarification.
- Recommendations

4.4 Responses and Corrective Actions

The EOR shall develop corrective actions and other responses as appropriate, based on the report submitted by the peer reviewer. Construction changes that affect the seismic resisting system shall be reported to the reviewer in writing for review and recommendations.

4.5 Distribution of Reports

All reports, responses and corrective actions shall be submitted to the responsible CSU Building Official. If the reviewer resigns or is terminated prior to completion of the project, then the reviewer shall submit copies of all reports, notes, and correspondence to the responsible CSU Building Official, the SRB, and the EOR within ten (10) working days of such termination.

4.6 Design Professional Responsibilities

The responsibility for structural design is fully and solely the responsibility of the design professional of record as outlined in the California Business and Professional Code.

The Seismic Peer Review is undertaken to enhance the quality of the design and to provide additional assurance regarding the performance of the completed project. Although the Peer Reviewer will exercise usual and customary professional care in providing this review, the responsibility for the structural design remains fully with the Engineer-of-Record.

4.7 Resolution of Differences

If the EOR does not agree with the recommendation of the peer reviewer, then the SRB shall resolve such differences.

Peer review should be a cooperative process between the structural EOR and project peer reviewer, both having the objective to produce a quality project. Direct and free communication between the Engineer-of-Record and project peer reviewer is vital to avoid misunderstanding. Despite this, honest differences may arise between the Engineer-of-Record and project peer reviewer. In such cases the EOR and project peer reviewer may determine the issue under consideration and the solution adopted may be controversial and would benefit from examination by the full SRB. Such cases will be presented to the SRB for consideration, evaluation and resolution. All interested parties will have the opportunity to present their technical arguments to the Board for its consideration. The peer reviewer will not participate in these proceedings as a member of the SRB. The decision of the SRB will be final.

4.8 Peer Review Contract and Cost

The Chancellor's Office maintains fully executed, system wide master enabling seismic peer review agreements with the peer reviewers. Terms and conditions, including specific services and fees, have been fixed in these agreements. Peer review fees are based on total project construction costs and shall not be amended without CPDC concurrence (SUAM 9212 and 9238). Copies of the agreements and amendments are provided for reference on the CPDC web site. To authorize services under these Agreements the campus need only execute a Service Order to the firm assigned to its campus.

5. SPECIAL CONSIDERATIONS

5.1 Design-Build and CM at Risk Projects

Design-Build and Construction Manager at Risk, and other project delivery systems (collectively called design build below) projects pose a special set of issues for application the CSU Seismic Requirements. CPDC maintains model procurement and contract language for use in Design-Building procurement to assure that CSU seismic requirements are incorporated in the procurement and implementation process. The intent is to insure adequate review of the seismic requirements for the project when the specifications are written. The specifications shall clearly define the code requirements and seismic performance requirements for the project, thus reducing the potential for additional charges in the event of disputes regarding code interpretation and peer review.

The requirements for Design-Build projects include provisions that peer review, plan check and testing and inspection services are paid for, and under the direction of, the University. The contract may contain a provision that the contractor shall reimburse the University under the contract for these services. In such case it is agreed that their duties with respect to the project are to the University as representative of the Trustees, and not to the contractor.

As noted in Section 4.2 seismic peer review of a project must be initiated when the project plans and specifications are in development, that is well before the request for proposals or qualifications are issued to potential performers.

5.2 Geotechnical Investigations

Determination of the seismic loading conditions requires that the building site's soils be classified. Any geotechnical investigation conducted for a project shall include consideration of all seismically induced site failure hazards, including liquefaction, differential settlement, lateral spreading, land-sliding, and surface faulting.

5.3 Special Moment frame structural systems

The following requirements apply when special moment frames structural systems are used:

1. Where rigid elements, such as ramps, exist in the structure, a detailed assessment of the interaction of the ductile frame and rigid element shall be completed to assure adequate post-yielding behavior of the structural system at the maximum expected deformation.
2. Columns with variable, unsupported height shall be ductily-detailed. As an alternate, double column support systems can be used to accommodate sections at breaks in elevation, with seismic separations between the columns and slabs.
3. For parking structures, all columns shall be special confinement reinforcing details, even if they are not part of the designated moment frame lateral load resisting system of the structure. Ramps are to be included in the structural model used for analysis, and the interaction effects and deformation compatibility requirements must be included in the design of the structural system.

Note that the policy includes **all** moment frame structures, including concrete, masonry, and steel.

5.4 Post-tensioned structural elements

Whenever post-tensioned concrete elements are used, the post-tensioned tendons may not be used as chords or collectors for delivery of lateral loads to lateral load-resisting elements.

5.5 Use of engineered wood products

1. The use of equivalently rated oriented strand board (OSB) as an alternative to plywood in shear walls and diaphragms is prohibited.

   Exception: The use of oriented strand board (OSB) may be used in areas where exposure to moisture is prevented.

   Examples of where OSB shall not be used include roof sheathing, exterior wall sheathing and floor sheathing under bathrooms and kitchens. Examples of where OSB is generally acceptable include interior wall sheathing and floor sheathing except beneath kitchens and bathrooms.

2. Plywood used as a part of the seismic load resisting system shall be at least 15/32 in. thick.
3. The construction documents shall require the Contractor to protect OSB and plywood during construction from exposure to water. If OSB or plywood deteriorates due to exposure to moisture, the material shall be replaced unless it can be demonstrated to the satisfaction of the engineer-of-record and campus seismic peer reviewer that no loss of strength has occurred.

5.6 Additional SRB Actions

The SRB may establish additional requirements relating to the design and construction of new buildings, and the retrofit or modification of existing buildings that have yet to be incorporated into this policy. The assigned peer reviewer is responsible for informing the project manager and design team of these additional

requirements as appropriate at the initiation of a project.

5.7 Non-building projects

The University has not formulated specific requirements for the demolition of structures, or for the seismic design and construction of non-building structures and utilities, or for planning and development of projects, except where the failure of such a structure poses a direct life-safety hazard to pedestrians nearby the structure, in which case the requirements for adequate seismic design and for peer review apply. Campus planners are urged to consider seismic hazards in planning, design, and construction of such facilities, particularly for those that should cross on encroach in earthquake fault zones. The SRB and the campus peer reviewer are available to the campus, its planning and development staff to provide technical advice and counsel on seismic aspects for such projects.

5.8 Deferred Approvals or Multiple Design Packages

Some projects may include more than one engineering firm in completion of the total design and construction. This may occur when there is a deferred submittal in the project design, (e.g., manufactured trusses or fire water-line pipe bracing), or when there are several designers engaged in the design (e.g., different firms designing foundations and superstructure for a design-build project). The design for such components or portions of a structure must be signed and stamped by a single engineer or architect responsible for the overall design, who also must be licensed in California. This individual shall be known as the engineer-of-record (EOR) responsible for the element submitted. For <u>each</u> component designed by others, that include a structural component as a part of the total construction project, the EOR has responsibility as follows:

1. The EOR must establish written criteria for design of the components, and other requirements as necessary for coordination of the components and their incorporation into the overall structural system and its design. These requirements are required to be completed before the project is approved for construction and be submitted for peer review prior to approval of the project.
2. The EOR must review the structural design and related documents including calculations of each component designed by others: for conformance with the stated design criteria; and for coordination with the overall structural design including the ability of the structure to support or brace the components.

The EOR's stamp and signature must be placed on the design documents for the components after the component engineer has signed and stamped the documents confirming that these requirements have been meet.

For non-structural elements, the EOR should define his/her limited responsibilities with a note such as:

> *"The EOR has reviewed the building components engineered by others for conformance with the project specifications and has verified that the structure can support the components as detailed. The EOR was not in responsible charge of the component design, but did provide the specifications and design criteria to which these components were designed and reviewed."*

When design of the component is completed and the EOR has signed the documents, then the seismic peer reviewer shall be provided a copy of the

component design, associated criteria, and construction documents for review and approval before the construction is implemented. If deferred approval or component elements are constructed before the reviews are completed, first by the EOR and then the peer reviewer, then the construction may be required to be removed and replaced by conforming construction.

5.9 Final Approval

Acceptance and completion of a construction project will only be given by CSU after the EOR states in writing that the permitted plan has been implemented and that any changes or deferred approvals for the project were completed with her/his written approval. Similarly, a statement will be required of the seismic peer reviewer that the reviews have been performed and that the issues raised were satisfactorily resolved.

5.10 Alternate Methods of Construction

Construction assemblies not specified in the California Building Code may be used provided that:

1. They have been accepted for use by the City of Los Angeles, Department of Building and Safety or the Division of the State Architect (DSA) and are used in accordance with the referenced research report or approved memorandum for application; or
2. The Building Official approves the application under the allowance of CBC Appendix A1 *Alternate materials, alternate design and methods of construction.* The Building Official may engage the responsible Seismic Peer Reviewer to examine any technical materials submitted in support of requests for alternate methods of construction that have implications on the seismic performance of the resulting construction.

5.11 Pre-engineered Structures

Pre-engineered structures often have certificates from ICBO or other certification authorities that are provided in lieu of specific engineering calculations demonstrating adequate seismic performance for the project for the specific seismic zone. These and the vendor's technical documents usually contain requirements for installation, which must be followed for the certificated performance to be achieved. The following requirements apply to such structures, which may include "Butler"-style buildings, awnings, bridges, and antennas. All such structures must have design documents signed and stamped by a licensed California professional

When the proposed structure is free-standing, with an acceptance certificate applicable to the site's seismic coefficients, then the structure may be accepted for CSU use without peer review of the seismic characteristics of the structure itself provided that there will be no applied loads to the structure other than its self-loads. This precludes adding floors or mezzanines to such structures, or placing storage racks or equipment that is braced to, or supported by, the structure. Piping, lighting, and similar elements may be attached to the structure only insofar as the manufacturer's specifications allow. Where the proposed structure has mezzanines or floors above grade level, then the structure shall be peer reviewed.

When the structure is not free standing, such as an environmental cover on a roof, an awning, cellular antenna, or similar addition to an existing building, and the element has a certificate applicable to the site's seismic coefficients, then the element may be

used without review of its seismic performance provided that the design limitations of the certificate are met and the structure to which it is attached is verified to be able to accommodate the applied gravity, wind, and seismic loads.

In all cases where the structure's certificate of approval does not specify foundation requirements, such as for a cellular antenna, then the foundation design shall be peer reviewed. Submittals shall provide the ICBO or equivalent certificate for the structure appropriate to the seismic environment of the site, and a report from a licensed California professional engineer that the foundations are capable of performing acceptably under the applied seismic loads, and these shall be peer reviewed.

Trailers or other transportable structures subject to CALTRANS, not Title 24, regulations are considered to be pre-engineered structures. When a trailer is placed and either the wheels are removed and/or are not in contact with the ground, then CSU seismic requirements apply. The peer review shall focus on the lateral bracing of the installation and not the unit itself, except as required to verify the capacity of the anchor points to transfer applied lateral loads.

For structures with attachment requirements to other structural elements of existing or new construction, such an entrance cover, or for a portable classroom (trailer), shall have the attachment design peer reviewed. The construction documents shall provide information applicable to the site's seismic zone, and a report from a licensed architect, or civil or structural engineer that the structure to which attachment is made is capable of performing acceptably under the applied seismic loads, and these shall be peer reviewed.

5.12 Private Buildings Constructed on CSU Land

When a private developer constructs a building on land owned or controlled by the California State University or any of its foundations or entities, then the project shall be peer reviewed in accordance with the requirements of this document.

6. POST EARTHQUAKE REVIEWS

When an earthquake occurs near a CSU campus or facility, there is immediate need for evaluation of the safety of buildings and facilities at the campus. The Chairman of the CSU SRB serves as a Deputy Building Official for purposes of such safety determination. After a significant seismic event, the Chairman will contact the campus to determine if damage occurred at the campus. If so, or if there are other reasons based upon public reports to suspect that damage occurred, the Chairman has been authorized to act as the Designated Building Official to evaluate the safety of buildings on campus and make recommendations for engineering investigations to determine the condition and appropriate actions to repair individual buildings.

When so notified, the university police will restrict occupancy or entry of all buildings on campus to those authorized by the Deputy Building Official for the campus to enter buildings for the purpose of determining their structural safety.

Following evaluation, all campus buildings will be posted as:

- Safe for occupancy (Green);
- Restricted entry (Yellow), with the limitations on entry explicitly stated on the placard; or
- Unsafe for entry (Red)

These designations shall be enforced by the University to limit the risk to occupants until such time as the risk is determined to be sufficiently reduced to allow placement of a less restrictive placard.

The restoration of the campus shall be completed to the requirements of Chapter 34. Plans for all repairs shall be approved for implementation by the SRB Chairman, or his designee, acting in his capacity as a CSU Deputy Building Official. The plans shall be peer reviewed as required above. With suitable record keeping, the reviews and plans may be developed and implemented rapidly with appropriate approvals. Where emergency shoring is required to stabilize a building to prevent its further deterioration, the scheme and plans for shoring shall be peer reviewed but do not require Building Official approval. After a suitable period of time, as determined by the Chancellor's Office, the Campus Deputy Building Official will reassume the responsibility for review and approval of the repair of damaged buildings.

The SRB has determined that welded steel moment frame buildings constructed to engineering procedures used prior to 1995 may be subject to significant damage that is not readily apparent without detailed investigation. When an earthquake occurs, all WSMF buildings in the region of strong motion shall be inspected to determine the conditions of their welded connections, even if the building shows no outward signs of damage. At the direction of the Deputy Building Official such investigations shall be completed for all WSMF buildings assessed to have been subjected to ground motions sufficient to have potentially caused WSMF connection damage.

During the post earthquake period, it may be necessary for a building to be condemned because its structural system is deemed in such condition that repair is not practical or that the building poses an unacceptably high seismic threat to other buildings. The Deputy Building Official has the authority to condemn buildings subject to review and confirmation by the CSU Building Official. Condemned buildings shall be demolished as soon as practical; in the interim period, the University shall take whatever actions are necessary to limit the possibility of injury to the public.

7. PROJECT PLANNING

The Chancellor's Office maintains a list of buildings identified by the Seismic Review Board for seismic retrofit. This list is divided into two categories; (1) those buildings that are a priority for seismic retrofit, that is, should be retrofitted as soon as resources are available without regard to other modifications of the building, and (2) those buildings that must be retrofitted when a major capital project is allocated to the building. The list is regularly updated and maintained on the CPDC website. Seismic evaluations and retrofit for buildings not on these lists may be required Chapter 34.

The Seismic Review Board regularly evaluates the buildings on each campus and off campus center to determine if changes in understanding of seismic hazard and/or structural performance warrant specific actions to moderate the seismic risk of specific buildings.

All planned projects shall meet the specific technical requirements of the CBC as detailed in previous sections of this document. A building meets the CSU requirements for seismic performance if it provides essential life safety to its occupants.

The requirements of the CBC, including Chapter 16 for new buildings, and Chapter 34 for modification of existing buildings, provide the minimum standards for construction. In many cases, modification of an existing building may not trigger seismic improvements to meet the requirements of Chapter 34 or other structural provisions of Title 24.

The Trustees' Seismic Policy requires that the feasibility study for all construction projects shall include consideration of the projects' seismic safety implications and shall be determined by weighing the practicality and cost of protective measures against the severity and probability of injury resulting from seismic occurrences. This applies all projects, including those that do not require Title 24 modifications of the structural system.

Planning for all capital projects, regardless of size, shall address the options considered to improve seismic performance beyond minimally required code conformance. The basis for determination of the selected option selected for implementation shall be documented in writing.

It is important to note that meeting the seismic design and construction practices described herein does not provide protection of property or equipment from earthquake destruction, or provide for the rapid restoration or maintenance of the building's functions or use after an earthquake.

8. SEISMIC SAFETY STANDARD FOR ACQUIRING BUILDINGS AND SPACE

It is the Standard of California State University (CSU) to acquire buildings and/or space in buildings owned by others that provide adequate seismic life safety to occupants. "Acquire building and/or space in a building' as used in this Standard refers to a right to occupy buildings or space resulting from a purchase, lease, license, transfer title, or other means. The requirements for meeting this Standard are set forth below.

All evaluations performed under this Standard are to consider the whole building and all its structural sections. Where a seismic hazard to the subject building clearly is posed by adjacent buildings, e.g., elevated unreinforced masonry wall that may collapse onto the subject building, these hazards are to be included in the assessment required below. It is not the intent of this standard to require detailed analyses of adjacent buildings.

I. Types of Acquisitions

A. Acquire By Lease or License (Upgrade As Per Lease Policy)

Newly leased or licensed space may be occupied only if it satisfies the seismic safety requirements of this Standard at the time the lease or license is executed, which can be established by one of the following:

1. A determination that a *Waiver Letter* can be issued, see Section II.A, or
2. A *FEMA 154 Evaluation Report* that indicates the building is not expected to pose a seismic safety risk, see Section II.B, or
3. A *Certificate of Applicable Code* indicates the building was designed to modern Code requirements and does not have characteristics known to be hazardous, see Section II.C, or
4. An *Independent Review Report* that states that the building has an earthquake damageability Level of IV or better, as defined in the table *Earthquake Damageability Levels for Existing Buildings,* see Attachment D.

The documents establishing any one of these may be produced by the campus, the building owner, or building owner's technical agent, and will be accepted subject to the review of the CSU as detailed in Section II. The documents resulting from the requirements of items 2, 3, or 4, above, remain valid for 12 months from

the date of their original issuance. This term can be extended for up to two years provided that a letter, signed and, where applicable, stamped by the author of the report or certificate, certifies that there have been: (i) no material changes in the structural system, either as part of building modifications, or as the result of accidents, and (ii) no change in the standards of evaluating buildings that would change the report's or certificate's conclusions, and (iii) no seismic event that could change the report's or certificate's conclusions.

B ACQUIRE BY PURCHASE OR TITLE TRANSFER

Whenever a building is acquired by purchase or other title transfer (e.g., exchange, gift), the due diligence examination of the property shall include a signed and stamped independent review report from a structural engineer licensed in the State of California or the state in which the property is located that meets the requirements of Section II.C, *Independent Review Report,* below. See also the table titled *Earthquake Damageability Levels for Existing Buildings* given in Attachment D.

Prior to acquisition of a building(s), CSU shall evaluate the building(s) and report on its seismic damageability. By Standard, a newly acquired building that has an evaluation of Level IV or better seismic performance may be occupied or continue to be occupied. A building with a Level V rating may be occupied or continue to be occupied only if the comprehensive and feasible budget and retrofit plan is in place at acquisition to retrofit it to achieve a Level IV within five years. A building with Level VI or poorer ratings must be seismically retrofitted to achieve a Level IV or better rating before it may be occupied. If the hazard classification depends on the seismic performance of adjacent structures, then mitigation can be achieved either by modification of the adjacent building hazard, or by protecting the subject building from the consequences of the adjacent building's seismic performance. Any retrofit work undertaken as part of a purchase to meet an assigned Level must be independently peer reviewed by CSU's structural engineer. The peer review shall be of the retrofit or modification design prior to construction and continue through completion of construction for conformance with the asserted Level. See the table titled *Earthquake Damageability Levels for Existing Buildings* given in Attachment D.

The requirements of this section may be waived if the building is unoccupied, will remain unoccupied after purchase, is to be demolished, will be sold without occupancy, or is a one or two-story, wood-framed single-family residence on a level site.

II. Acceptable Evaluation Documents

A. Waiver Letter

The requirements for seismic evaluation under this Standard may be waived under the following limited conditions,

1.1 The space will be occupied for less than two years, and CSU does not currently occupy space in the building, or

1.2 The area of the space to be occupied by CSU is 3,000 sf, or less, and the space is not to house pre-school age children, or

1.3 The building is a one-story, wood-framed building, or a one or two-story, wood-framed single-family residence on level site, or

1.4 The building is a re-locatable structure, such as a trailer, even if permanently located, but only if the structure does not have a natural gas connection, or

1.5 The building is subject to the regulatory authority of the Office of Statewide Hospital Planning and Development, or is a schoolhouse regulated under the Field Act by the Division of the State Architect, (and accordingly is otherwise evaluated pursuant to a rigorous seismic safety standard) or

1.6 The space to be occupied is within a structure currently occupied by and previously evaluated and accepted under this Standard by any of the named entities, or

1.7 The space must be occupied because of administrative requirements beyond the control of CSU as certified by a policy level person. Each CSU organizational unit shall designate the person(s) authorized to make such waivers.

Any Waiver Letter of issued under one or more of the above allowances must be in writing by the person making such determination.

For any building not qualifying for a Waiver Letter, proceed to Section II.B, below, *FEMA 154 Evaluation report*.

B. FEMA 154 Evaluation Report

Seismic compliance may be met by an evaluation using FEMA 154 methodology (Rapid Visual Screening) that results in a score higher than the Basic Hazard Score provided in the FEMA handbook, see Section III for references. The FEMA 154 benchmark years for building types in Table 2-2 are replaced by ASCE 31 Table 3-1 (Benchmark Buildings) for different building types. All California counties are assumed to be in areas of High Seismicity (H) for this purpose. In FEMA 154, a total score, S, equal to or higher than 2 is determined as life-safe without further technical assessment. A total score below 2 requires that further technical investigation is required.

For any building not qualifying for a favorable FEMA 154 report, proceed to Section II.C or II.D below.

FEMA 154 evaluations may be performed by professional civil engineers, or registered architects, or by individuals within CSU who have been trained in the use of the Rapid Visual Screening method.

C. Certificate of Applicable Code

A Certificate of Applicable Code (Certificate) may be provided if the entire building was constructed under a permit approved by the local jurisdiction and was designed to meet one of the following requirements:

1. 1998 or subsequent editions of the California Building Code; or,
2. 1976 or subsequent editions of the Uniform Building Code and the building do not have any one of the enumerated characteristics or conditions listed below:
    - unreinforced masonry elements, whether load-bearing or not; not including brick veneer;
    - precast, prestressed, or post-tensioned structural or architectural

elements, except piles;

- flexible diaphragm (e.g., plywood)-shear wall (masonry or concrete) structural system constructed pursuant to editions of the Uniform Building Code prior to the 1997 edition;
- apparent additions, alterations, or repairs to the structural system made without a building permit;
- constructed on a site with a slope with one or more stories partially below grade (taken as 50% or less) for a portion of their exterior;
- soft or weak story, including wood frame structures with cripple walls, or is construction over first-story parking;
- seismic retrofit of the building, whether voluntary or mandated, whether partial or complete;
- repairs following an earthquake;
- welded steel moment frames (WSMF) that constitute the primary seismic force-resisting system for the building, and the structure was designed to code requirements preceding those of the 1997 edition of the Uniform Building Code, and the building site has experienced an earthquake of sufficient magnitude and site peak ground motions that inspection is required when any of the conditions of Section 3.2 of FEMA 352 indicate an investigation of beam-column connections is warranted;
- visible signs of distress or deterioration of structural or non-structural systems, e.g., excessively cracked and/or spalling concrete walls or foundations, wood dry rot, etc.

The Certificate must be signed and stamped by an architect, civil engineer, or structural engineer licensed by the State of California or the state in which the property is located, who certifies that the Certificate was prepared by this person or under this person's direct supervision. The Certificate must contain an assurance that the signatory was responsible for, and performed the bulk of the work reported in the Certificate, and has ownership interest in the property.

For a building not qualifying for a Certificate, proceed to Section II.D, *Independent Review Report*.

D. Independent Review Report

An Independent Review Report of the entire building and of its critical nonstructural components shall be prepared by a structural engineer licensed by the State of California or the state in which the property is located, who has had no prior involvement in the building's design or evaluation, and has no ownership interest in the property.

As a matter of policy, all acquisitions by Purchase or other Title Transfer (see Section I. A. above) require an Independent Review Report. The Entities will not approve for occupancy a newly leased building having an earthquake damageability level of Level V or poorer. See the attached table titled *Earthquake Damageability Levels for Existing Buildings* given in Attachment D.

The Independent Review Report and its preparation, at a minimum, shall include the following:

4.1 A visit to the building to observe its condition and characteristics.

4.2A review of available design drawings and soil reports for original construction and subsequent modifications.

4.3 A qualitative (and quantitative, if needed) evaluation of the building's gravity and lateral load resisting structural systems;

4.4 A qualitative (and quantitative, if needed) evaluation of the likelihood of earthquake-induced site failure that could cause damage to the facility, that is, the building is in the vicinity of earthquake faults listed in the State of California Earthquake Zones Act of 1990 (previously Alquist-Priolo) or liquefaction susceptibility zone as identified by the local jurisdiction, or the building site is subject to failure due to earthquake-induced landslide risk;

4.5 A qualitative (and quantitative, if needed) evaluation of the expected seismic performance of the building following the loading requirements of the current edition of the California Building Code, Title 24, Chapter 16, Division VI-R, Section 1640A2.1 for the building type, site location, and physical conditions;

4.6 Identification of any potential falling hazards in areas that will be occupied or common areas within the building that poses a life-safety threat to the building occupants during an earthquake.

4.7 An evaluation of the earthquake damageability Level of the building using the definitions of the attached table, *Earthquake Damageability Levels for Existing Buildings,* given in Attachment D.

4.8 A list of the documents, plans, and other materials examined.

For leases, if a landlord intends to complete modifications to bring a building into compliance with the required Level (minimum) shall: i) certify that the work to be completed will meet the requirements of this section, and (ii) provide a description of the work in sufficient detail to allow CSU's technical review and approval. In either case, confirmation that the completed modifications meet the requirements of this section shall be done by the landlord's structural engineer.

The *Independent Review Report* must be signed and stamped by the professional, who certifies that the evaluation was Level IV or better before occupancy occurs, then the landlord's structural engineer must state that the work was done by this person or under this person's direct supervision, that they have no prior involvement in the building's design or evaluation, and the firm or individuals of the firm have no ownership interest in the property. CSU may have the Independent Review Report prepared to meet Section 8.II requirements peer reviewed to confirm its technical reliability prior to acceptance of the report's conclusions and reliance upon it in execution of the real estate transaction.

III. References

Code of California Regulations, Chapter 7.5. California Public Resources Code.

ASCE-31. *Seismic Evaluation of Existing Buildings*, American Society of Civil Engineers, Reston, Virginia, ASCE/SEI Standard 31-03, 2003.

ASCE-41. *Seismic Rehabilitation of Existing Buildings*, American Society of Civil Engineers, Reston, Virginia, ASCE/SEI Standard 41-06, 2006.

California Building Code, *California Code of Regulations, Title 24*, California Building

Standards Commission, Sacramento, California. Current edition.

FEMA 154, *Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook*, Second Edition, Federal Emergency Management Agency, Washington D.C., March 2002.

FEMA 352. Recommended Post-earthquake Evaluation and Repair Criteria for Welded *Steel Moment Frame Buildings,* Federal Emergency Management Agency, Washington D.C., July 2000.

ATTACHMENT A

CSU SEISMIC REVIEW BOARD MEMBERSHIP

The following persons are members of the CSU SRB:

- Charles Thiel Jr., Ph.D., Chairman; President, Telesis Engineers
- Gregg E. Brandow, Ph.D., S.E.; President, Brandow and Johnston Inc.
- John Egan, G.E.; Principal Engineer, Geomatrix Consultants
- John A. Martin Jr., S.E.; President, John A. Martin and Associates
- Richard Niewiarowski, S.E., Principal, Rutherford and Chekene
- Thomas Sabol, Ph.D., S.E., Principal, Englekirk and Sabol Consulting Engineers
- Theodore Zsutty, Ph.D.; S.E., Consulting Structural Engineer, Professor Emeritus, San Jose State University

Attachment B

Seismic Coefficients for CSU Campus Locations

If there is a known active fault that traverses the campus as determined by the California Division of Mines and Geology or the Seismic Review Board, then it is so indicated, see Section 4.

Contact the Seismic Review Board through the campus peer reviewer for assignment of the appropriate values for sites not listed or that is not a part of the contiguous campus.

Seismic Coefficients for CSU campuses for Soil Type B at the campus are provided below in Table 1. See the notes at the end of the Table.

Table 1 - CSU Campus Seismic Ground Motion Horizontal Response Spectra Parameters

Campus	Level of Seismicity	Active Fault Zone	BSE-2 (MCE)			BSE-1 (DE)			BSE-R			BSE-C		
			S_{PGA} (g)	$S_{.2s}$ (g)	S_{1s} (g)	S_{PGA} (g)	$S_{.2s}$ (g)	S_{1s} (g)	S_{PGA} (g)	$S_{.2s}$ (g)	S_{1s} (g)	S_{PGA} (g)	$S_{.2s}$ (g)	S_{1s} (g)
Bakersfield	High	No	0.48	1.15	0.43	0.32	0.77	0.28	0.20	0.47	0.18	0.35	0.84	0.32
Bakersfield - Antelope Valley	High	No	0.74	1.70	0.84	0.50	1.13	0.56	0.36	0.77	0.34	0.66	1.52	0.76
California Maritime Academy	High	No	0.60	1.50	0.60	0.40	1.00	0.40	0.34	0.82	0.31	0.53	1.29	0.50
Chancellor's Office	High	No	0.77	1.81	0.70	0.51	1.21	0.47	0.28	0.65	0.24	0.57	1.33	0.49
Chancellor's Residence	High	No	0.72	1.73	0.66	0.48	1.15	0.44	0.27	0.63	0.23	0.53	1.23	0.46
Channel Islands	High	No	0.77	1.73	0.71	0.51	1.16	0.48	0.36	0.85	0.30	0.64	1.55	0.58
Chico	Moderate	No	0.26	0.60	0.23	0.17	0.40	0.15	0.10	0.22	0.10	0.18	0.41	0.17
Dominguez Hills	High	No	0.73	1.74	0.67	0.49	1.16	0.44	0.28	0.65	0.24	0.53	1.25	0.47
East Bay - Hayward	High	Yes Hayward	1.25	2.88	1.19	0.83	1.92	0.79	0.52	1.19	0.46	0.97	2.32	0.89
East Bay - Contra Costa	High	No	0.96	2.22	0.83	0.64	1.48	0.55	0.43	1.01	0.35	0.74	1.77	0.63
Fresno	Moderate	No	0.20	0.48	0.22	0.14	0.32	0.14	0.09	0.21	0.10	0.14	0.34	0.16
Fullerton	High	No	0.71	1.69	0.61	0.47	1.13	0.40	0.29	0.68	0.26	0.52	1.23	0.45
Humboldt	High	Yes Fickle Hill	1.10	2.64	1.08	0.73	1.76	0.72	0.46	1.07	0.38	0.83	1.98	0.78
Humboldt-Trinidad	High	No	1.18	2.75	1.18	0.79	1.84	0.79	0.41	0.96	0.34	0.90	2.09	0.84
Long Beach	High	No	0.70	1.66	0.62	0.46	1.10	0.42	0.26	0.62	0.23	0.50	1.18	0.44
Los Angeles	High	No	0.86	1.92	0.67	0.57	1.28	0.44	0.38	0.89	0.31	0.73	1.70	0.57
Monterey Bay - East Campus	High	No	0.55	1.30	0.58	0.36	0.87	0.38	0.23	0.54	0.22	0.40	0.96	0.42
Monterey Bay - West Campus	High	No	0.54	1.29	0.56	0.36	0.86	0.37	0.23	0.53	0.21	0.40	0.95	0.41
Moss Landing Marine Lab	High	No	0.59	1.43	0.60	0.39	0.95	0.40	0.28	0.64	0.24	0.46	1.09	0.49
Northridge	High	No	1.02	2.30	0.81	0.68	1.54	0.54	0.48	1.12	0.38	0.84	2.02	0.67
Pomona	High	Yes San Jose	0.87	2.15	0.77	0.58	1.43	0.51	0.38	0.91	0.34	0.67	1.60	0.58

Campus	Level of Seismicity	Active Fault Zone	BSE-2 (MCE)			BSE-1 (DE)			BSE-R			BSE-C		
			S_{PGA}	$S_{.2s}$	S_{1s}	S_{PGA}	$S_{.2s}$	S_{1s}	S_{PGA}	$S_{.2s}$	S_{1s}	S_{PGA}	$S_{.2s}$	S_{1s}
			(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)	(g)
Sacramento	Moderate	No	0.23	0.55	0.23	0.15	0.36	0.16	0.10	0.24	0.11	0.17	0.40	0.18
San Bernardino	High	No	1.16	2.71	1.27	0.77	1.81	0.85	0.64	1.48	0.62	1.03	2.45	1.20
San Bernardino - Palm Desert	High	No	0.88	2.03	0.98	0.59	1.35	0.65	0.41	0.92	0.36	0.75	1.70	0.80
San Diego	High	No	0.46	1.11	0.40	0.31	0.74	0.27	0.16	0.38	0.15	0.33	0.77	0.28
San Diego-Calexico	High	No	0.63	1.50	0.61	0.42	1.00	0.41	0.39	0.93	0.34	0.61	1.53	0.60
San Francisco	High	No	1.05	2.46	1.17	0.70	1.64	0.78	0.47	1.03	0.46	0.88	2.03	1.04
San Francisco-Tiburon	High	No	0.60	1.50	0.70	0.40	1.00	0.47	0.36	0.84	0.35	0.56	1.33	0.62
San Jose	High	No	0.68	1.55	0.66	0.46	1.03	0.44	0.39	0.93	0.34	0.58	1.43	0.57
San Jose-South Campus	High	No	0.68	1.55	0.66	0.46	1.03	0.44	0.38	0.91	0.34	0.57	1.41	0.56
San Luis Obispo	High	No	0.52	1.23	0.47	0.35	0.82	0.31	0.17	0.41	0.18	0.35	0.82	0.33
San Marcos	High	No	0.43	1.05	0.40	0.29	0.70	0.26	0.19	0.45	0.18	0.32	0.77	0.30
Sonoma	High	No	0.97	2.23	0.91	0.64	1.49	0.61	0.37	0.83	0.35	0.75	1.72	0.73
Sonoma - Los Guilicos	High	No	0.64	1.50	0.62	0.43	1.00	0.41	0.30	0.71	0.29	0.57	1.34	0.53
Stanislaus	Moderate	No	0.31	0.76	0.28	0.21	0.51	0.19	0.13	0.31	0.13	0.23	0.55	0.22
Stanislaus - Stockton MCRC	Moderate	No	0.35	0.84	0.29	0.23	0.56	0.19	0.14	0.34	0.14	0.25	0.59	0.22

Notes:

1. The campus seismic ground motion parameters given in this table correspond to Site Class B, as utilized in ASCE 7-05, ASCE/SEI 41-06, and the 2007 California Building Code.
2. Adjustments for site class at a given building site shall be made using site class coefficients F_a and F_v given below in Tables 2a and 2b, respectively. Site class shall be determined base on site-specific soil and/or rock properties in accordance with the site class definitions given in ASCE 7-05, ASCE/SEI 41-06, and the 2007 California Building Code.

Table 2a. Site Coefficient, F_a

Site class	Short-Period Response Spectral Acceleration Parameter, S_{X-S} (g)									
	≤0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	≥2.5
A	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
B	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C	1.30	1.20	1.10	1.05	1.00	0.95	0.90	0.90	0.90	0.90
D	1.60	1.40	1.20	1.10	1.00	0.90	0.85	0.80	0.80	0.80
E	2.50	1.70	1.25	1.00	0.90	0.85	0.80	0.75	0.70	0.70
F	Site-Specific Ground Motion Procedures									

NOTE: Use straight-line interpolation for intermediate values of S_{X-S}.

Table 2b. Site Coefficient, F_v

Site class	One-Second Response Spectral Acceleration Parameter, S_{X-1} (g)									
	≤0.1	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**≥1**
A	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
B	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
C	1.70	1.60	1.50	1.40	1.30	1.25	1.20	1.20	1.20	1.20
D	2.40	2.00	1.80	1.60	1.50	1.40	1.35	1.30	1.30	1.30
E	3.50	3.10	2.80	2.60	2.40	2.20	2.10	2.00	2.00	2.00
F	Site-Specific Ground Motion Procedures									

NOTE: Use straight-line interpolation for intermediate values of S_{X-1}.

3. Ordinates characterizing the respective hazard level (X) response spectrum for a given building site at a particular campus shall be obtained using the following:

   $S_{X0} = F_a * S_{X-PGA}$

   $S_{XS} = F_a * S_{X-.2S}$

   $S_{X1} = F_v * S_{X-1S}$

   in which 'X' represents the respective hazard level [i.e., BSE-2 (MCE), BSE-1 (DE), BSE-R, or BSE-C] being evaluated.

4. The active fault zones are indicated by the appropriate fault zone special studies map issued by the California Geological Survey. The earthquake fault zone for the San Jose fault is indicated on the map prepared for and issued by the CSU Seismic Review Board.

Attachment C

Assigned Peer Reviewers

The following peer reviewers are assigned for the respective campuses and associated locations. All peer reviews for the indicated campuses or their off-campus locations are to be performed by the named individuals or their designees. For other locations the Seismic Review Board will assign the peer reviewer.

Campus	Principal Peer Reviewer
Bakersfield	Gregg Brandow
California Maritime Academy	Charles Thiel
Chancellor's Office	John A. Martin Jr.
Channel Islands	John A. Martin Jr.
Chico	Richard Niewiarowski
Contra Costa	Richard Niewiarowski
Dominguez Hills	Thomas Sabol
East Bay	Richard Niewiarowski
Fresno	Charles Thiel
Fullerton	John A. Martin Jr.
Humboldt	Charles Thiel
Humboldt-Trinidad	Charles Thiel
Long Beach	Gregg Brandow
Los Angeles	Gregg Brandow
Monterey Bay-East Campus	Theodore Zsutty
Monterey Bay- West Campus	Theodore Zsutty
Northridge	Thomas Sabol
Pomona	John A. Martin Jr.
Sacramento	Theodore Zsutty
San Bernardino	John A. Martin Jr.
San Bernardino-Palm Desert	John A. Martin, Jr.
San Diego	Gregg Brandow
San Diego-Brawley	Gregg Brandow
San Diego-Calexico	Gregg Brandow
San Francisco	Charles Thiel
San Francisco-Tiburon	Charles Thiel
San Jose	Theodore Zsutty
San Jose South Campus	Theodore Zsutty
SJSU - Moss Landing	Theodore Zsutty
SJSU Marine Laboratory	Theodore Zsutty
San Luis Obispo	Thomas Sabol
San Marcos	Thomas Sabol
Sonoma	Richard Niewiarowski
Sonoma-Los Guilicos	Richard Niewiarowski
Stanislaus	Richard Niewiarowski
Stanislaus-Stockton	Richard Niewiarowski

In addition, for investigations that are undertaken specifically to investigate the occurrence of geologic and geotechnical seismic hazards (e.g., faulting, liquefaction, land sliding), John Egan shall be the peer reviewer for all locations within the CSU system.

Attachment D

Earthquake Damageability Levels For Existing Buildings

Rating Level [1,5]	Definitions based upon California Building Code (CBC) requirements for existing buildings [2]	Implied Risk to Life [3]	Implied Seismic Damageability [4]
I	A building evaluated as meeting or exceeding the requirements of CBC Chapter 34 for Occupancy Category IV performance criteria for a new building.	Negligible	0% to 10%
II	A building evaluated as meeting or exceeding the requirements of CBC Chapter 34 for Occupancy Category IV performance criteria with BSE-R and BSE-C categories replacing those given in Chapter 34.	Insignificant	0% to 10%
III	A building evaluated as meeting or exceeding the requirements of CBC Chapter 34 for Occupancy Category I-III performance criteria with BSE-1 and BSE-2 categories replacing BSE-R and BSE-C as given in Chapter 34; alternatively a building meeting CBC requirements for a new building.	Slight	5% to 20%
IV	A building evaluated as meeting or exceeding the requirements of CBC Chapter 34 for Occupancy Category I-III performance criteria.	Small	10% to 30%
V	A building evaluated as meeting or exceeding the requirements of CBC Chapter 34 for Occupancy Category I-III performance criteria only if the BSE-R and BSE-C values are reduced to 2/3 of those specified for the site.	Serious	20% to 50%
VI	A building evaluated as not meeting the minimum requirements for Level V designation and not requiring a Level VII designation.	Severe	40% to 100%
VII	A building evaluated as posing an immediate life-safety hazard to its occupants under gravity loads. The building should be evacuated and posted as dangerous until remedial actions are taken to assure the building can support CBC prescribed dead and live loads.	Dangerous	100%

Notes:

1. Earthquake damageability levels are indicated by Roman numerals I through VII. Assignments are to be made following a professional assessment of the building's expected seismic performance as measured by the referenced technical standard and earthquake ground motions. Equivalent Arabic numerals, fractional values, or plus or minus values are not to be used and are undefined. These assignments were prepared by a task force of state agency technical personnel, including CSU, UC, DGS, DSA, and AOC. The ratings apply to structural and non-structural elements of the building as contained in Chapter 34, CBC requirements.
2. Chapter 34 of the California Building Code, current edition, regulates existing buildings. It uses and references the American Society of Civil Engineers Standard *Seismic Rehabilitation of Existing Buildings, ASCE-41.* All earthquake ground motion criteria are specific to the site of the evaluated building. The CBC definitions for earthquake ground motions to be assessed are paraphrased below:
   - BSE-2, the 2,475-year return period earthquake ground motion,the lesser of the maximum Capable Earthquaake for the site under certain limiting conditions
   - BSE-C the 1,000-year return period earthquake ground motion.
   - BSE-1, two-thirds of BSE-2 value, nominally the 475-year return period earthquake ground motion.
   - BSE-R the 225-year return period earthquake ground motion.

Notes Continued:

3. *Implied Risk to Life* is a subjective measure of the threat of a life threatening injury or death that is expected for an average building in compliance with the indicated technical requirements. The terms *negligible* through *dangerous* are not specifically defined, but are linguistic indications of the relative degree of hazard posed to an individual occupant.
4. *Implied Damageability* is the level of damage expected to the average building in compliance with the indicated technical requirements when a BSE-2 level earthquake occurs. Damage is measured as the ratio of the cost to repair the structure divided by the current cost to reconstruct the structure from scratch. Such assessments are to be completed to the requirements of ASTM E-2026, where the damage ratio is the SEL evaluated at Level 1 or higher in order to be considered appropriate.
5. In those cases where the engineer making the assessment using the requirements for a given rating level conclude that the expected seismic performance is consistent with a one-level higher or lower level rating, this alternative rating level may be assigned if and only if an independent technical peer reviewer concurs in the evaluation. The peer review must be completed consistent with the requirements of Section 3420, 2007 CBC.