STRUCTURAL DESIGN GUIDELINES
Design Standard

PART 1 GENERAL

1.1 PURPOSE

The following Structural Design Guidelines establish basic design parameters for the San Mateo County Community College District (SMCCCD) with the goal of providing enhanced structural performance, improving constructability, optimizing end user flexibility and serviceability, and encouraging green building practices. These guidelines are to aid in application of and in some cases augment the current building code requirements and are to be used in conjunction with specific requirements identified for each campus and/or building.

1.2 LATEST EDITION OF CALIFORNIA BUILDING CODE

A. The design professional should design all buildings to the latest version of the California Building Code (CBC) as adopted and amended by the Division of the State Architect – Structural Safety/Community Colleges (DSA-SS/CC) per CBC Section 1.9.2.2.

B. Where additional structural design guidance is required, the design professional should reference the parallel Division of the State Architect – Structural Safety (DSA-SS) to determine if additional direction is given there.

1.3 LATEST EDITION OF DESIGN PROVISIONS

A. Building codes do not always keep up with the constantly evolving Design Provisions upon which they are based. The revised provisions will eventually be incorporated into the building codes but may not be fully in place at the time the design professional is developing the design documentation.

B. For example, the 2001 CBC, Chapter 22/22A-Steel, Division IV-Seismic Provisions for Structural Steel Buildings, was based on the Seismic Provisions for Structural Steel Buildings of the American Institute of Steel Construction, dated April 15, 1997. There was an important update to the Seismic Provisions made in 2005, which incorporated many revisions based on research programs and other investigations related to the seismic design of steel buildings. These Seismic Design Provisions were not adopted into the building code until the 2007 CBC.

C. Therefore, the SMCCCD anticipates that the design professional will review, and where prudent, utilize the latest edition of the Design Provisions which form the basis of the building codes. This requirement provides improved structural system (seismic) performance by conformance to improved system detailing based on lessons learned from recent seismic events and ongoing research. Compliance to the latest Design Provisions for a given material will ensure that SMCCCD buildings have structural systems that incorporate the most current knowledge as it relates to the practice of structural engineering.

1.4 ESTABLISHING IMPROVED SEISMIC PERFORMANCE PARAMETERS

A. The purpose of the CBC prescribed earthquake design provisions is to primarily safeguard against major structural failures and loss of life. Therefore, code level design does not provide for other factors that, dependent on the building use, may also be important to the SMCCCD. These may include limiting damage to structural, mechanical or architectural

elements; maintaining functionality of structure post-earthquake; and/or structures that will facilitate simple repair of damaged structural elements.

B. The design professional should confirm if any special circumstances for improved structural seismic performance for the particular building being designed are desired by the SMCCCD. Conversely the design professional should inform the district representatives if they, as design professionals, see the need or benefit to include provisions above the CBC requirements.

1.5 DSA COLLABORATIVE PROCESS FOR COMMUNITY COLLEGE PROJECTS

A. The State Architect has an established alternate plan review process available for projects on Community College Campuses. DSA BU 09-07 Bulletin: Collaborative Process for Community College Projects outlines this process that engages DSA early and throughout the design process. The bulletin establishes both an informal and formal Collaborative Process (CP). The informal process allows for DSA to respond to issues raised by the design team in preliminary review meetings. The formal CP entails meetings with assigned DSA personnel at set milestones for review of plan and calculation development.

B. Participation in the CP benefits the project by allowing for discussion of critical structural system decisions and analysis approaches between the design professional and DSA staff early in the design process. For complex projects the formal CP provides a higher level of confidence that significant code compliance issues will not arise during the plan review phase. It can also aid in reducing the final plan review schedule and can result in less conservative design assumptions. SMCCCD encourages participation in the DSA CP process.

1.6 SPECIAL INSPECTION AND TESTING REQUIREMENTS

A. Special inspection and testing services are required on all projects falling under the DSA-SS/CC jurisdiction. The cost of these services is typically borne by the Owner as a soft cost of the project. The design professional will provide to the SMCCCD a list of the special inspection and testing required for each proposed structural designs so that the SMCCCD can make informed decisions about which design solutions offer the best overall value. This list shall include, but is not limited to, testing and inspection indicated in the geotechnical report as well as those indicated in the CBC.

1.7 STRUCTURAL IRREGULARITIES

A. Structural irregularities typically consist of plan irregularities such as reentrant corners (L-shaped buildings) or vertical irregularities such as discontinuous lateral resisting systems (shear walls or frames that are not continuous to the foundation). These structural irregularities are defined in the ASCE 7, Minimum Design Loads for Buildings and Other Structures, Chapter 12, Table 12.3-1 and 12.3-2, which is adopted by reference in the CBC. The presence of structural irregularities can influence the overall seismic performance of the building and necessitate the use of amplification factors which may increase overall structural costs. Therefore, the SMCCCD expects that the design professional will limit or eliminate such structural irregularities. District representatives will review exceptions on a case by case basis.

1.8 SEISMIC JOINT GUIDELINES

A. Seismic joints typically provide a separation between buildings with different lateral systems and/or provide a joint for expansion and contraction of very large or long structures. Their use, however, can complicate detailing and construction of architectural, mechanical, electrical, fire protection and plumbing systems and may require a greater degree of maintenance over the building’s lifespan. Therefore, the SMCCCD anticipates that the

design professional will minimize the use of seismic joints to the greatest extent possible. The SMCCCD will review exceptions on a case by case basis.

1.9 STRUCTURAL FRAMING SYSTEMS

A. The SMCCCD understands that when designing a structural framing system, the design professional has choices. The SMCCCD anticipates that the design professional will consider the advantages and disadvantages of the options, present them to the District representatives along with a recommendation on which structural system is most appropriate for the project.

B. The design team is expected to take advantage of economies offered by structural systems that are uniform in nature by establishing regular grids and framing bays to the greatest extent possible.

C. The design team is expected to evaluate their proposed system with respect to economic, aesthetic, performance, and schedule impacts.

D. SMCCCD has set district wide standards for the modular size of different systems including furniture and cubicles. In the interest of maintaining flexibility of spaces in the future, the SMCCCD anticipates the design professional will provide a structural system that accommodates these modular standards. The modular standards are indicated in the Administrative Space and Instruction Space Design Standards.

1.10 STRUCTURAL LATERAL RESISTING SYSTEMS

A. The SMCCCD anticipates that the design professional will consider the advantages and disadvantages of a variety of lateral load resisting systems, present them to the District representatives along with a recommendation on which system is most appropriate for the project.

B. The design team is expected to evaluate their proposed system with respect to economic, aesthetic, performance, and schedule impacts.

C. When considering the use of a steel braced frame system, the SMCCCD encourages the use of Buckling Restrained Braced Frames (BRBF). BRBF provide enhanced performance over traditional braced frame systems due to their improved hysteric behavior which dissipates seismic energy, their smaller connection plates, and their ease of replacement following a seismic event if required. Exceptions to this would be one-story buildings, rooftop penthouses, and bracing of mechanical equipment supports. SMCCCD also expects the design team to evaluate and accurately present the true cost and aesthetic impact of the braced frames with respect to loss of square footage, visual impact, and usage interruption.

1.11 MINIMUM FLOOR LIVE LOADS

A. Building uses can change over time. In order to maintain greater flexibility for new building spaces, a minimum floor live load is required by SMCCCD. The floor live load shall be as indicated in the CBC Table 1607.1, but no less than 80 pounds per square foot applied concurrently with a minimum 15 pounds per square foot partition load, per CBC Section 1607.5, for the design of all framing members. This is a minimum design live loading. The use of higher live loads may be required for certain use types. It is the responsibility of the design professional to determine the appropriate live loading for floors if they exceed this minimum.

1.12 MINIMUM MECHANICAL WELL LIVE LOADS

A. In order to maintain greater flexibility, for not only the future but also for final equipment selection, the designer should design the entire mechanical well area for a minimum roof live

load of 80 pounds per square foot. The designer should evaluate the applicability of this minimum mechanical live load. It should not be less than code design loads and also not be less than that required to support design equipment weights. By designing the primary framing to support this loading secondary framing can be specifically located later without requiring redesign of the main framing members.

1.13 FLOOR FIRE RATINGS

A. Design structural floor systems with the applicable fire ratings required for the specific use of the spaces on each side of the floor structure, and which are compliant with the code requirements of the agencies having jurisdiction.

1.14 FLOOR VIBRATION DESIGN PARAMETERS

A. The vibration of floors due to walking, rhythmic activities, or mechanical equipment can have a negative impact on the comfort level and productivity of building occupants and can also be detrimental to sensitive laboratory equipment. Vibration control is not mandated by building codes but the design professional should be aware of its impact on the perceived and actual building performance. All suspended floor systems should be evaluated for vibration based on the intended usage. The design team should be aware of areas of special concern with regards to floor vibrations. Spaces that are programed to include rhythmic activities, machine rooms, large open meeting spaces, and areas with sensitive laboratory equipment require special design attention.

1. Two guidelines that are available to evaluate floor vibrations are:

   a. Design Guide 1: Minimizing Floor Vibration by the Applied Technology Council

   b. Design Guide 11: Floor Vibrations Due to Human Activity by American Institute of Steel Construction

B. To verify that the proposed structural system has been designed for vibration control, the SMCCCD requires the design professional to submit their vibration control design, including drawings and calculations signed and stamped by a licensed Structural Engineer in the State of California, as part of the 90% Construction Document submittal for review by the Owner's Representative.

1.15 FLOOR FLATNESS

A. The SMCCCD expects the design team to include reference to criteria from ACI 117 in the project specifications to ensure appropriate floor flatness (Ff) and levelness (Fl) is achieved for the building usage.

B. The SMCCCD also expects the design team to properly indicate and detail areas requiring floors and/or roofs to slope to a drain to ensure such drainage is achieved.

1.16 SLAB-ON-GRADE DESIGN PARAMETERS

A. Slabs-on-grade with excessive water/cement ratios and improper subgrade systems can result in excessive cracking of the slab, curling of the edges of the slab, and moisture entrapment which can affect the attachment of architectural finishes to concrete floors. Therefore, the SMCCCD requires the design professional to specify concrete mix designs with a maximum water/cement ratio of 0.45 and a minimum concrete compressive strength of 4000 psi. A vapor barrier is required below all inhabited spaces. The subgrade shall be as specified by the geotechnical engineer and it should not include a layer of material between the vapor barrier and the underside of the concrete slab where moisture could get trapped. The design team should be involved in the specification and review of final layout of control and construction joints to ensure slab performance.

1.17 CONCRETE ON METAL DECK ROOFS

A. Attachment of mechanical, electrical and plumbing systems, structural bracing and architectural features to the roof structure can be problematic with a bare metal deck roof structure. DSA has strict requirements for anchorages to structure which are not easily met with a bare metal deck roof. In addition to facilitating structural attachments, the use of structural concrete fill over the metal decking can help control sound and vibration transmission, negate the use of sprayed on fire proofing, and maximize flexibility for future adaptability. Therefore, the SMCCCD anticipates that the design professional's roof structure will include structural concrete fill on all metal deck roofs. The SMCCCD shall consider exceptions on a case by case basis. Exceptions may include architectural features such as canopies and stand-alone covered walkways.

1.18 SUSTAINABLE BUILDING REQUIREMENTS

A. San Mateo County Community College District is strongly committed to promoting sustainability throughout their campus projects. Section 01 81 13 Sustainability of the Design Standards provides guidelines and recommendations for implementing sustainability strategies. Where relevant, specific sustainability criteria is noted in this section; however, each project team should review and cross reference that front section while developing the specific project and its documentation. Each discipline shall confirm that specific performance and manufacturer information provided in the specification section is in alignment with code requirements, LEED criteria, and any other goals for sustainability.

B. Sustainable buildings not only reduce the impact on the environment but can provide for a more efficient structure with an improved quality of indoor spaces. The design professional is expected to incorporate as many sustainable features into the structural system as reasonably possible, these may or may not include the following:

1. Fly Ash: A common green building practice includes the substitution of fly ash or slag for cement in foundation concrete mix designs. The use of fly ash improves concrete's durability and workability, diverts fly ash from landfill and reduces cement production, and the slower set times (56 days vs. 28 days) do not affect foundation work. Additionally, the more refined finished surface may negate the need for a flooring finish, reducing cost and improving indoor air quality. Therefore, the District anticipates that the design professional will specify a high volume fly ash (50%) foundation concrete mix design that maximizes the percentage of fly ash/slag replacement for cement while maintaining the specified design requirements for the foundation.

2. Structural Steel: Approximately 95% of steel is recycled, making it a good material for achieving sustainability goals. This includes steel shapes, reinforcing bars and metal decking.

3. Recycled Aggregates: Recycled aggregates can be used for slab sub-base.

4. Regional Materials: When possible, specify regional materials (within a 500 mile radius), locally harvested products, and locally manufactured products to support local economies and reduce transportation waste.

1.19 PEER REVIEW OF GEOTECHNICAL REPORT

A. SMCCCD requires peer review of geotechnical reports. This requirement promotes the completeness of reports, challenges overly conservative recommendations that can add significant construction cost, and promotes exploration of possible efficiencies (for example, increases in allowable bearing pressures can result in significant savings during construction).

END OF SECTION