This report summarizes a comprehensive structural design analysis for the construction of the Campus Centre building located in Planning Area 6 (PA6) in the City of Irvine. The project is a six-story mid-rise office building framed from structural steel (total square footage is 27,375 ft² per floor plus an 806 ft² mechanical penthouse). The structural members will consist of steel girders, beams, columns, and connections (i.e. welds and bolts). Concrete over metal deck will be used for individual floors, with slab on grade typical at ground level. Lateral force resisting systems will consist of both steel braced and moment frames. Shallow foundations of concrete spread footings will be used. The analysis consisted of vertical and lateral loads.

The design objective for the mid-rise office building is to provide residents in the community with various employment opportunities. The creation of the structural system must serve three primary objectives. First, the design must be in keeping with the architectural plans and the client’s wishes. Second, it must provide a cost effective design in a timely manner that will enhance the quality of life by allowing residents to live, work and play in the same community. Finally, the structure must provide safety, serviceability, and efficiency in resisting all gravity and lateral loads. The design of the structure will be aesthetically pleasing with glass windows covering the building, allowing the scenic terrain to play a role in the buildings appearance.

The Final Design Report (FDR) serves as the 100% submittal with a complete design for the office building. In this phase of the design process, major consideration was placed on the lateral system, while the gravity system was designed in the 30% submittal. Lateral designs initially required development of wind and seismic loads to determine the governing load. Also, adding seismic provisions into the building’s design will require revision of some beam, column, and footing sizes. Base plates and footing designs will be completed, along with running RAM to determine the final sizes of all columns and beams. Also, connections will be checked to determine their adequacy. Concurrently, the lateral system was design- four braced frames along stairwells in the East-West direction and two moment frames along the exterior walls in the North-South direction.
The design approach for the office building begins with load development based upon architectural plans. The framing plan is developed based upon spacing requirements for available decking. The W2 FORMLOCK Verco decking with 3 ¼ inch requires that the beams not be spaced greater than 13 feet. The decking will be the decking will lie on beams that will be designed to work together with the decking and composite beam design, which make for a stronger and more economical design. The framing plan consists of 146 beams at floor levels and 143 beams at the roof. There are 44 columns with splicing between the 3rd and 5th floors running through the main portions of the building. The penthouse is composed of 8 columns (4 attached to the main building columns) and 11 beams with a brace frame in each direction. The penthouse lateral system was design as a separate structure as required by ASCE-7. Columns based on the lateral design are W10, W12, or W14 A992 steel members. The foundation was designed with a code minimum allowable 1500 psf bearing pressure for the 30% design when geotechnical data was not available; once a report was available a bearing pressure of 5000psf was used in design. The footings range between 4’x4’ concrete pads to 10’x10’. Grade beams were used for the footings for the moment frames. Drag and chord beams were designed for lateral forces in the transverse and longitudinal directions. These members transfer the loads to the brace and moment frames in order to resist lateral loads.

Environmental documentation required for the structural design includes a Negative Declaration as required by the California Environmental Quality Act (CEQA). The negative declaration is used because the proposed project will have no significant effect on the environment.

The engineer’s estimate of probable construction cost is estimated to be approximately $ 23.2 million. The breakdown by building components is: Decking = $1.9 million, Structural Steel = $3.9 million Exterior building features (i.e. windows and building skin) = $8.6 million, Utilities = $5.8 million Elevators = $960,000, Foundation = $923,200, Lobby cores = $510,000, Roof = $430,500 and Site preparation = $180,000. The cost estimate for the final design is less than the cost estimate provided in the 30% submittal as the cost in structural steel decrease due to the use of composite beam design in the final design.

The projected development schedule is approximately 15 months (1.25 years) with construction set to begin on June 15th and conclude in September 2010. The breakdown by key tasks is: Bidding process = 30 days, Construction planning = 30 days, Phase 1 (foundation) = 60 days, Construction Phase 2 (building frame) = 30 days, Construction Phase 3 (decking and installations) = 45 days, Construction Phase 4 (building skin) = 75 days, Construction Phase 5 (landscaping and parking) = 40 days.

The next tasks are to finalize labor contracts with contractors to begin the construction of the steel office building. Close monitoring will be required during construction with an engineer on site. Some design changes may occur on the site due to availability of materials or unforeseen conditions. The project schedule allows for as-built changes to the design. The proposed project is expected to be constructed in 15 months.

SABEENGineering is looking forward to providing the City of Irvine with a safe and economical design for an office building that will provide employment opportunities for Irvine residents. The mid-rise steel office building combines an aesthetically pleasing windowed façade with a reliable structural interior that will provide adequate safety and serviceability for the occupants and for the city. The design will meet OSHA provisions and be environmentally friendly, combining two important aspects utilized throughout developments within Irvine.