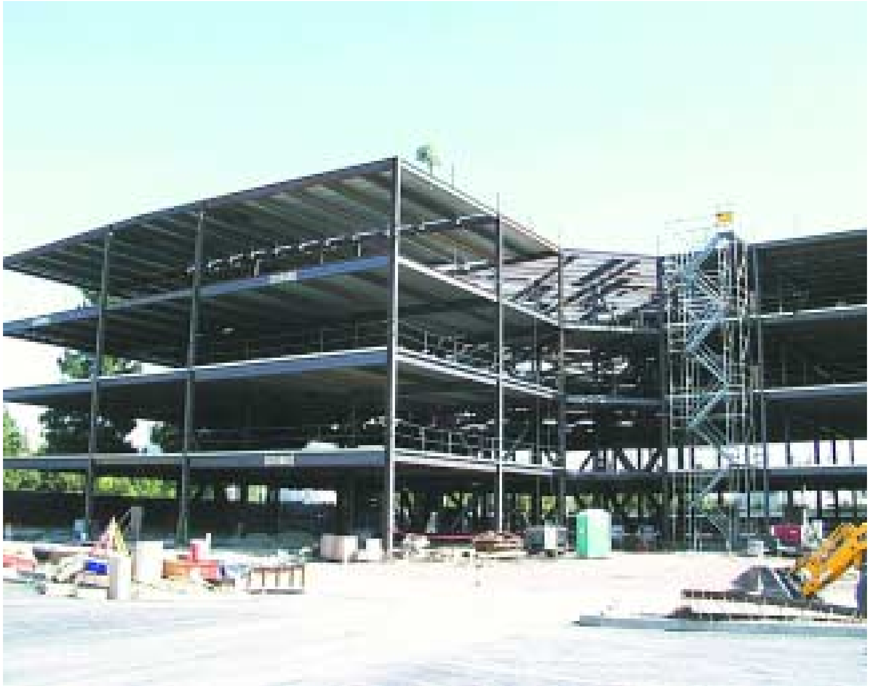
Design team works together

Saving Time and Money with Design Build



By Steve Miller and Roger O'Hara, P. E.

Civic Center Place, a recently completed 110,000-sq.-ft., four-story steel office building located in Fremont, CA displays the success of the design/build process.

The owner/developer had specific site, schedule, aesthetic, and financial requirements for this speculative project and chose DPR Construction, Redwood City, CA to perform design/build construction services along with Bunton and Clifford Architects. DPR, in turn, looked to Stearns for design/build services for the structural frame, stairs, and metal deck. KPFF Consulting Engineers, Portland office, worked with Stearns on the steel structure design and was the structural engineer of record for the project.

Once the conceptual architectural layout was established for the 200' long by 200' wide, L-shaped building, structural framing alternates were budgeted and layouts reviewed for coordination with other trades. Upon acceptance of the chosen scheme, a firm price, scope, and schedule were established.

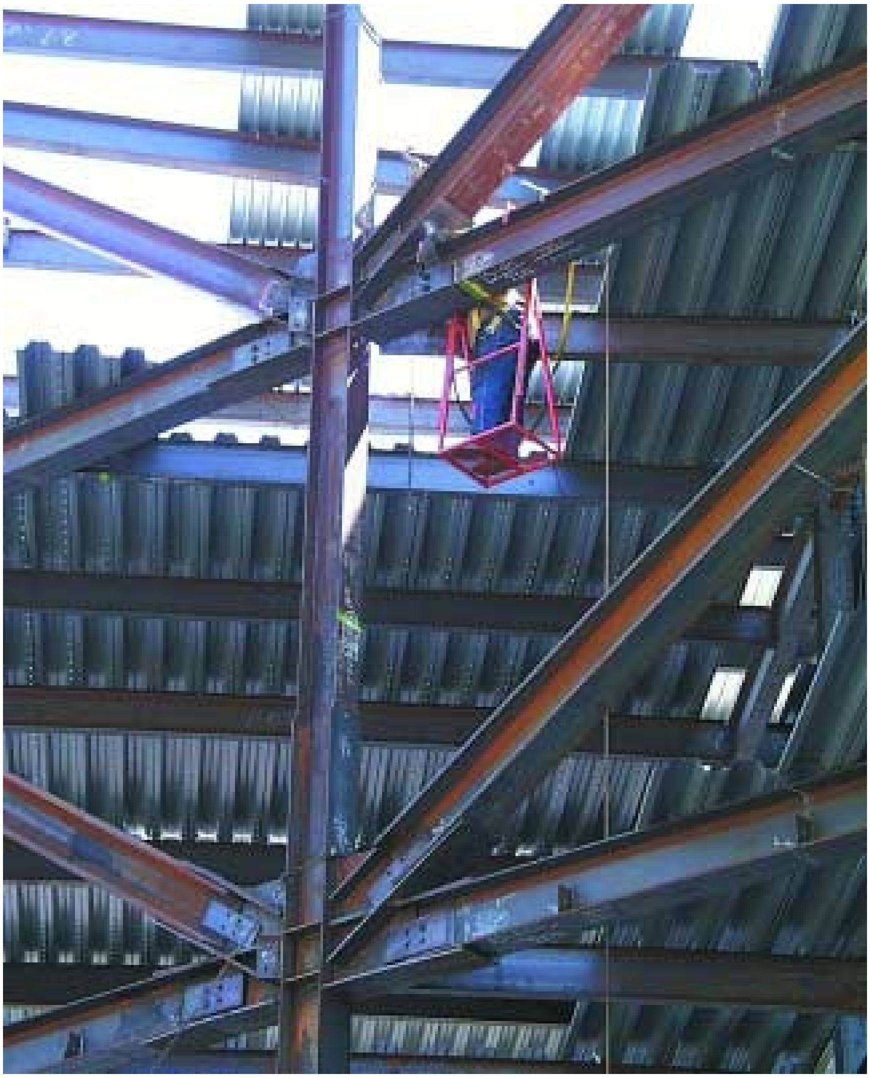
The design of the structure posed unique challenges. The project is located in seismic zone 4, less than 2 kilometers from the Hayward fault, with a soil profile type Sd. The structure was designed per 1997 CBC (California Building Code) and the City of Fremont's inclusion of the AISC's "Seismic Provisions for Structural Steel Buildings" published on April 15, 1997. These factors produced the highest possible seismic design forces per equation 30-5 of the 1997 CBC. Therefore, the design and detailing of the lateral force resisting elements proved critical to the cost and schedule of the project.

Stearns and KPFF decided to utilize ordinary brace frames rather than the more costly and erection-time consuming moment frames. The exterior of the building consisted of GFRC, EIFS, and window walls, negating perimeter frame placement. V-brace and two story X-brace ordinary frames were located within interior wall spaces.

Due to the non-orthogonal brace frame orientation with respect to the building axes, the lateral resisting system was modeled utilizing ETABS. The high seismic forces posed challenges in the design of the foundation and roof diaphragm. Typical floors consisted of 3" metal deck with 2-1/2" lightweight concrete topping. The roof, with the exception of a concrete mechanical core pad, consisted of 1-1/2" metal deck. High roof diaphragm forces and low diaphragm shear values necessitated the need for seismic collector lines extending across the length of the building. Relatively small soil bearing loads combined with minimal dead loads on seismic resisting columns resulted in large, continuous spread footings. Pile options were investigated, but it was decided that the placement of continuous foundations and grade beams, in specific areas to engage extra dead load, proved more cost effective.

Brace Frame Design

Several issues which complicated the brace frame design and detailing consisted of design force levels requiring wide flange brace members in lieu of more cost-effective square tubes or pipes (brace and column sizes up to W12x190), columns at intersecting brace frames, and frame orientation placed at angles to the principle axis. Stearns and KPFF



collaborated to create brace frame details that satisfied high load demands, simplified erection, and met budget and schedule requirements. Despite the high seismic load considerations, the final weight of the structural frame was less than 10 lbs. per square foot.

Meetings between members of the design team, contractor and subcontractors throughout the project design phase made for a cohesive design/build team. Decisions were made jointly and responsively, allowing shop detailing to begin during design. Wide flange members for brace frames and floor framing were ordered just three weeks after the start of design.

Fabrication and Erection

Stearns' fabricator/erector combination was selected through a bid process from completed design and shop drawings. This information, provided with structural materials, a detailed schedule, and delivery and erection sequences, allowed fabrication completion with few questions over a short duration. Advance construction planning, started at the conceptual design phase, helped create a streamlined erection process.

A 90-ton mobile crane was used for the "billboard" erection process in five zones. Total erection duration, including deck installation, was four weeks.

"Stearns' and their team executed the project seamlessly." said DPR's project manager, Jody Quinton. "Decisions were made quickly and accurately and the results had no change-orders and no surprises. We were pleased with the design/build steel process."

Design/build success

The concept of design/build involves fundamental changes in the business relationships between the owner, architect, general contractor, and design/build subcontractors. At the core of these relationships are trust, communication, and the desire for mutual success.

Three distinct advantages of the design/build process are the contractor's active involvement in the design, decreased schedule durations, and development of better relationships between the construction and design team.

The steel industry is poised to change the delivery models currently in practice. Design/build steel contracting is a proven and successful process that can benefit many projects.

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Why Design/Build?

The project delivery method known as design/build has become significant in the construction industry over the past few decades. The cooperative effort of owner, consultants, and design/build contractors can prove to be the best method of project delivery.

The mechanical and electrical trades have been effectively utilizing design/build construction for many years. However, within the steel industry, typical contracting involves traditional design/bid/build methods. In taking this approach, the knowledge and influence of fabricators and erectors is absent during design when key project decisions influencing cost and schedule are determined. The quality and level of completeness of the design documents presented for bidding are dominant factors in initial costs, subsequent change orders, and project schedule delays, often leading to adversarial relationships.

In recent years, owners and contractors, recognizing the benefits of design/build in other trades, have opted to utilize this method for steel construction. By incorporating a design/build steel contractor as a member of the design team, results include:

- Framing optimization based on geometry and material availability
- Advanced material ordering
- Emphasis on constructibility
- Expedited design process
- Streamlined shop drawing approval process
- Condensed schedules
- Continuous cost accountability
- Reduced risk for the general contractor and owner
- Improved teamwork and relationships

R. F. Stearns, formed as a design/build steel company in 1981, identified that by being involved in a project from conceptual design through completed installation, competitive up-front pricing, faster schedules, quality structures, and repeat customers were realized. Over the years, Stearns developed the staff, tools, and knowledge required to successfully complete complex, schedule-driven steel structures—from office buildings to aircraft hangars to high-tech industrial facilities—in a design/build format.