

# HSS. LESS WEIGHT EQUALS LESS COST.



*Pueblo Buildings four-story loft condominium*

# HSS SHOWS SIGNIFICANT COST ADVANTAGES OVER CONCRETE IN NEW CONDOMINIUM/ APARTMENT BUILDING SYSTEM

In many applications, the excellent strength-to-weight ratios of steel Hollow Structural Sections (HSS) provide HSS with a significant cost advantage over other types of steel structurals.

Now, a patented new manufactured structural system has demonstrated that HSS can enjoy a substantial cost edge over concrete and be competitive with wood structures, as well.

Developed by Pueblo Building Technologies, LLC, of San Francisco, the patented system meets the structural needs of multi-family residential buildings, hotels, senior housing and dormitories from four-to-eight stories. It offers substantial advantages in initial cost, quality, speed of construction, weight reduction and design flexibility.

## HSS Makes Pueblo Concept Succeed

"HSS was the key to bringing our concept of an efficient and quickly erected manufactured framing system to reality," says Tom Graf, a principal in Pueblo Building Technologies. "We wanted to contain the column members within the walls, and the high strength-to-weight ratio of HSS make



that possible. The HSS framing system is only about 25 percent of the weight of a comparable concrete structure, but it furnishes the strength mandated in high seismic areas such as California."

At the same time, Graf adds, the HSS system maximizes the usable floor space in a building, compared to the encroachments on floor space caused by the massive columns and beams of a similarly-sized concrete structure.

Graf says that Pueblo Building Technologies estimates costs in the \$25-\$26 per-square-foot range for building frames four-to-eight stories high ready for

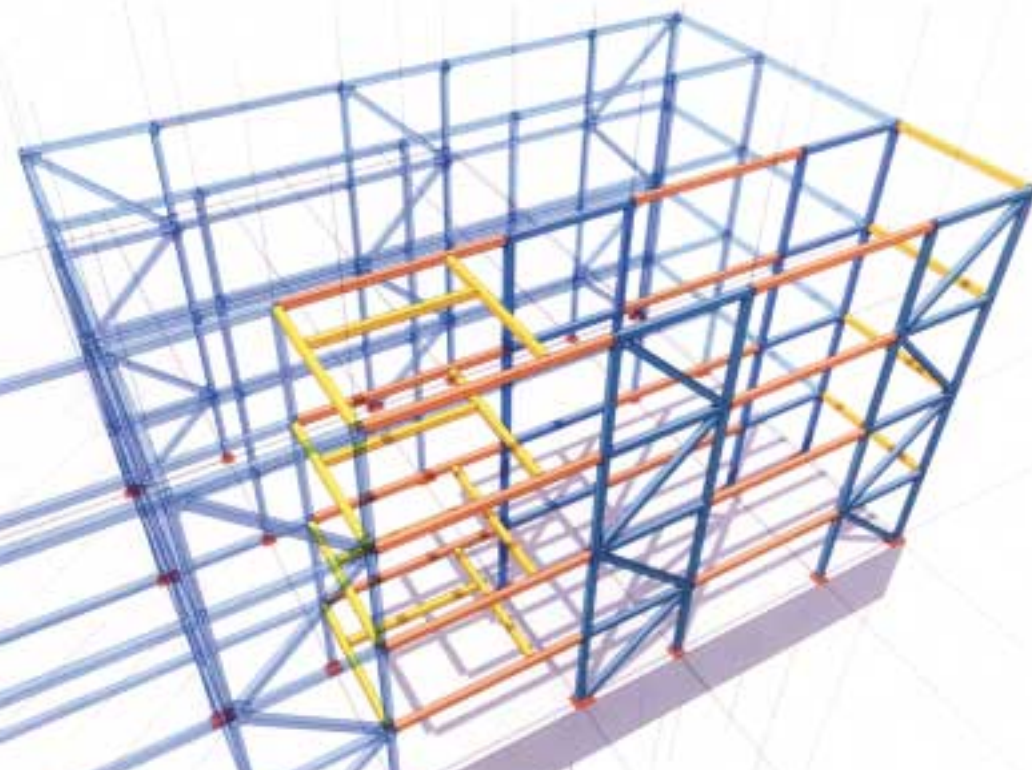
drywall, versus \$32-\$33 per-square-foot for a similarly-sized building of concrete construction — a savings of about \$7 per-square-foot. Costs include partition and wall framing for both systems. Both estimates are for the San Francisco area, which has high labor costs and stringent seismic requirements.

## Frame Assemblies Rise As High as Eight Floors

The Pueblo system uses cold-rolled HSS for its structural members, coupled with light-gauge steel floor panels. Its structural framing includes a shop-fabricated HSS ladder frame and braced frame assemblies, which can extend up to as much as six floors in height, and be stacked up to 12 stories.

The ladder frames are formed by two square HSS vertical members connected by square HSS "rungs" and support only gravity loads. The braced frames include square HSS diagonals and provide resistance to lateral loads such as wind and seismic shock, in addition to gravity loads. Two braced frames, placed at right angles, are positioned in each 700 square-foot of floor space.

Rectangular HSS members connect the vertical frames to form a three-dimensional structural cage. Angle mounting brackets are welded to the vertical members of the frame assemblies; some during fabrication, others during erection. Then the connecting HSS members are lowered into the brackets and fillet welded.





Light-gauge steel floor panels are placed so they rest on "L" brackets, shop welded to the connecting members every two-to-three feet, and the concrete slab is poured to complete the structural system.

## Loft Condominium Shows System's Value

The initial building incorporating the Pueblo manufactured framing system is a four-story, 47,000-square-foot loft condominium building in San Francisco. A structure such as this, including pouring of concrete floors, can take only 12 weeks to complete. "The site foremen of the steel fabricator and the erector were impressed with the ease and speed in which the prefabricated system was put in place," Graf reports.

The framework of the condominium required about 230 tons of HSS. Six-inch square HSS was used for the ladder and braced frames comprising the vertical assemblies. Each of the HSS columns is a single section approximately 45-feet long,



welded to a base plate mounted on the roof of a one-story parking garage. The members used to connect the column assemblies are 4" x 6" and 6" x 8" rectangular HSS.

## Shop Assembly Adds To Cost Advantage

Part of the HSS cost advantage over concrete, and its competitiveness with wood structures in buildings incorporating the Pueblo system, lies in the fact that it is easily fabricated, stacked and transported.

Graf notes that doing much of the work in the shop takes advantage of labor rates that are generally one-third less than those for the same work done in the field. And shop fabrication assures better quality

control — tolerances as close as 1/16" of an-inch — than can be achieved when the work is done in a controlled environment.

He also cites the "off-the-shelf" availability of HSS as major benefit. "It's normally available within a week, versus possibly weeks or even months for other types of steel structurals, so fabrication can start almost immediately upon the approval of shop drawings."

"The way our system works," he adds, "HSS readily lends itself to the jig systems used to form the ladder and braced frames in the shop. And because these tubular assemblies are relatively light and just ten feet wide, they can be readily stacked on trucks for delivery to the job site."

Because of their reduced weight, the HSS assemblies are easier to handle and less costly to erect, since lighter-capacity cranes can be used.

The initial building utilizing the Pueblo technology was built by Cassidy Construction of San Francisco. The framing was fabricated and erected by Dublin Steel of Lodi, California. The architect was the system's inventor, Jorge DeQuésada, a principal in Pueblo Building Technologies.

Graf and DeQuésada plan to promote the future growth of the patented Pueblo technology by licensing it to fabricators or contractors, and to provide engineering support services as required.

They view the technology as a quantum leap over existing systems for manufactured structures, which can be used only



for standard floor plans. "It's extremely flexible," Graf says. "By varying the placement of the frame assemblies and increasing or decreasing the length of the connecting beams, this system is adaptable to virtually any floor plan."

"And it's just the beginning," he concludes. "By fine tuning this system we'll be able to reduce a number of the other costs associated with the construction of multiple-occupancy residential buildings."

## The Steel Tube Institute

The Steel Tube Institute was founded in 1930. It sponsors cooperative member efforts to improve manufacturing technology in the welded steel tubing industry and informs architects, design and structural engineers, contractors, fabricators and other customers about the product's utility and versatility.

## What is HSS?

Hollow Structural Sections (HSS) is high-strength welded steel tubing used as structural elements in buildings and other structures and a variety of manufactured products. It is produced in round, square and rectangular shapes and a broad range of sizes. Benefits include aesthetic appeal, high strength-to-weight ratios, uniform strength, cost-effectiveness and recyclability.



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