# Composite Joist Advantage

David Samuelson

For the last four decades, composite joists have been a convenient solution for different types of steel construction. But while the availability of composite joists has increased over the years, not all contractors are familiar with their design or how to use them.

A composite joist provides a shear-stud connection between a joist top chord and its overlying concrete slab. The connection allows the steel joist and concrete to act together as an integral unit after the concrete has cured. Composite joists offer a number of potential advantages, depending on the project:

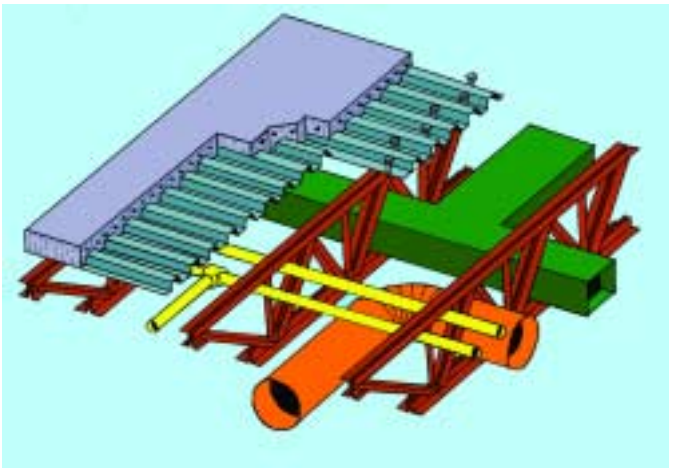
- Ability to route mechanical HVAC, plumbing and electrical lines through the joist open webs.
- Ease of moving HVAC during life of building.
- Better plenum space utilization.
- Floor-to-floor height can be reduced by not having to run mechanical lines under the joists.
- More efficient and stiffer composite design makes it possible to support a given load with a shallower joist.
- Weight savings from the joist design reduces building costs.
- Simplified erection, faster connections and minimal crane lifts. With fewer and simpler connections, ironworkers don't have to align a large number of bolt holes.
- Large column-free areas give tenants maximum flexibility on floor layouts. Composite joists have been used successfully in floors with spans exceeding 100'.
- Customized composite joist designs for any given loading and serviceability requirements.

The most important advantages are speed and the ability to support long spans economically. "The longer spans, 35' to 40' and longer—that's when composite joists really shine," said Dave Henley, Vulcraft district sales manager in Denver. "It's a lighter section, and that becomes increasingly significant over the longer spans. We see a lot of 30'-by-30' bays, which are a common size in the composite floor business. The good news is we can expand that without the cost becoming astronomical."

Henley says a ballpark cost estimate for composite joists for a typical 30' bay with a live load of 70 psf and a dead load of 60 psf is about $1 per sq. ft. That includes the joists, delivery, and the cost and installation of the studs. With an increase in the live load to 100 psf (typical for corridors and other gathering places), costs rise to about $1.20 per sq. ft.

Extending the span to 40' increases the joist cost by about 10%, assuming a proportional increase in depth. At the same depth, cost tends to increase proportionately with the length.

Composite joists also coordinate well with other building disciplines. A typical example is



the 26-story 312 Elm Street building in Cincinnati. The lower 10 stories, covering 410,000 sq. ft, used cast-in-place concrete for the parking garage. Composite joists spanning 48.5' supported the upper 16 steel-framed office floors, which covered 326,000 sq. ft. The project had a 16-month construction schedule and $60-million budget.

Use of composite joists, along with excellent coordination among the various building disciplines, cut anticipated cost by $2.4 million and helped shave six weeks from the schedule.

An ongoing project using composite joist is the Framatome Advanced Nuclear Power Facility in Lynchburg, VA. The composite joists specified (22" deep, 54' long) support 1,270 lb per linear foot and are approximately 31% lighter and 10% stiffer than an equivalent wide-flange beam. These composite joists will be delivered four weeks after approval.

It is key to identify the "typical" composite joist sizes and loadings for a given project. Designs should be run for those typical composite joists considering the full range of shear-stud sizes available, selecting the lowest combined installed cost for the composite joists and shear studs. It generally is not cost effective to have multiple sizes of shear studs on a project, so optimize the shear-stud size selection for the typical composite joist.

For years, a contractor couldn't count on composite joists being available. But that's no longer the case, says Bob Steckel, partner and project engineer with Ambrose Engineering, Inc. in Cedarburg, WI. Now the main concerns for contractors center on product design and their lack of familiarity with composite joists. The size and quantity of the required shear studs can vary. "Upfront, he'll want to know how many studs he has to install, which impacts his erection costs," Steckel said. "We'll give him a ballpark figure based on Vulcraft's catalog." Vulcraft will determine the optimal shear-stud size considering thickness and width of the composite-joist top-chord angles.

In the past eight years, Ambrose Engineering has designed about 300 stores for Kohl's with composite joists. Most of the Kohl's stores were one-floor designs with a second-story mezzanine, or had a two-story design. Steckel says the composite-joist design provides a larger column-free area with shallower members. Composite joists also provide a simpler and more economical connection to a masonry wall. In the space of the composite joists, the contractors run electrical and piping.

Ambrose Engineering recently completed about 25 Kohl's stores in the Los Angeles area, and some contractors were initially unfamiliar with composite joists. "We'll send Vulcraft's catalog with a good description of composite joists," Steckel said. "That, plus the joist suppliers' expertise, usually is all the constructor needs." ★

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