

# Room to Breathe

Linda Norris

Long-span joists fill the need for long-term structural flexibility.

**L**ong-span joists are the successful intersection of engineering precision with fabrication accuracy. These pieces are the practical answer to developers' needs for wide-open space.

Brian Stoddard of Atlantic Engineering designed the Southeast Toyota Distribution Center, which opens early next year in Jacksonville, FL.

"It wasn't that they needed the open space that much right now, but they wanted to be flexible for the future," he said.

Flexibility is a key feature of projects that utilize long spans. Many architects and engineers who specify the long-span joists begin with plans on the drawing board that assume more conventional structural solutions. But customers like Toyota, who need extensive distribution facilities, look for unobstructed space to move their product. In the case of the Florida facility, Toyota wanted a building that could house a parking lot where cars could be detailed and finished. Long-span joists were the solution.

Once the key members of the building team knew that the owner wanted a 200 ft by 800 ft free space the team met to determine the most economical solution. Though columns were considered, the answer to Toyota's request was 200-ft-span roof trusses spaced at 18 ft-6 in. on center, attached with a system of horizontal bracing, and with 12K1 joists as secondary members. To

facilitate on-site installation, the trusses were assembled and tested in Canam Steel's fabrication plant in Jacksonville. Once the fit was guaranteed, the trusses were disassembled before delivery and assembled on site.

Angelo State University's Junell Center, in San Angelo, Texas is another example.

"The University needed a versatile structure for many events and public gatherings," said Tom Evans, of fabricator Canam Steel. Sporting events require column-free space. Evans designed the joists, which span the 224-

ft width of the arena to meet this requirement.

The corners of Junell Center's main arena are clipped at a 45-degree angle, for an octagonal building plan. Joist girders support 33 long-span joists that circle the perimeter of the arena. The typical long-span joist is double pitched, has a depth of 10 ft in the center and weighs nearly 18 tons.

Evans said that engineers looked carefully at the deflection and response of the roof system under possible loading scenarios, and then doubled-up several joists over the stage area to sup-



Erection of long-span joists at Angelo State University's Junell Center (San Angelo, TX).



Southeast Toyota Distribution Center (Jacksonville, FL) under construction.



Old Dominion Convocation Center (Hampton Roads, VA) under construction.

port extra lighting, rigging and audio equipment. Each joist was fabricated with a specific camber, taking into consideration the roofs' dead load, the joists' own weight, and deflection under future loading.

The joists had to be transported in three pieces. They were assembled in the plant and then separated to assure a good fit in the field. The bolted field splices used high-grade ASTM A490 bolts designed for bearing use. This was to simplify on-site assembly of the joists by avoiding bolt-tightening procedures and surface preparation that is required of a friction connection.

Other arenas also showcase long-span joists. Old Dominion Convocation Center, in Hampton Roads, VA, was another facility that needed wide-open space for basketball games, college graduations and university events.

The joists in this case were 239 ft long, and the longest joists Canam had ever manufactured. Unlike the other long-span projects, this time the 17 trusses—weighing 17 tons each—were assembled in the fabrication shop in

one piece, then disassembled into three pieces for transport.

A 3-D space frame, an arched dome with a tension ring/compression hub, and conventional, fabricated-steel trusses with short-span joists were all considered before super long spans were chosen, said Edward Pence, senior vice president for Stroud, Pence and Associates Engineers.

“The first reason was cost—they were considerably less expensive than other options,” he said. “Second, they fit the architect’s vision of the building better. Third, was the anticipated speed of erection and flexibility of design. Fourth, they accommodated the lighting platforms and catwalks well.”

As owners increase their demand for clear space, long-span joists continue to provide the necessary breathing room.

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