

structurally  
sound

## SEEING THE FOREST FOR THE STEEL TREES



Lynn Bryant

**WE OFTEN THINK OF BANDS** making the festival circuit, but sculptures?

Designed by industrial artist Charles Gadeken, ENTWINED consists of five sculptural steel trees. One tree was installed at last year's Beyond Wonderland music festival in San Bernardino, Calif., and then three months later, all five appeared at the Electric Daisy Carnival in Las Vegas; two of them also traveled to this year's Toronto Light Festival. Together, the trees form an interactive climbing grove and gathering space for festival attendees from day to night, providing a shady place of repose during daylight hours and an entrancing experience come nightfall, complete with glowing colored LED "leaves."

California-based engineering firm Holmes Structures provided structural engineering services for the trees, factoring in potential seismic and wind loads, as well as anticipated climbing loads imparted by ambitious fans. Each tree consists of a sculpted steel form creating the roots, trunk, branches and canopy, with overall shapes inspired by the acacias and mangroves of Africa. The trees vary in size, ranging from 6 ft tall with a 7.5-ft canopy to 20 ft tall with a 25-ft canopy. The leaves are made of 4-in. and 8-in. plastic cubes, each equipped with individually computer-controllable LEDs, enabling a multitude of colors to flow through them in hypnotic waves.

ENTWINED was designed to meet the 2015 *International Building Code* as a non-building structure that resists both seismic and wind-induced lateral forces. The custom structural members and connections were designed to facilitate easy assembly, disassembly and transport to the next location without distracting from the piece's aesthetics. To this end, Holmes Structures designed subtle and temporary slot-bolted bearing connections that attach root to trunk, trunk to branch and branch to canopy. These connections are contingent on a single bolt that is dropped into place and locks to connect two parts (e.g., branch and trunk) together. The connections also create a smooth, curvilinear finish in contrast with the industrial aesthetic that externally bolted (and permanently welded) connections would have provided.

Holmes Structures worked closely with Gadeken, industrial designer Ray Sykes and metal sculptor Jessika Welz to deliver a custom structural solution within a tight schedule; the design team had a three-week turnaround time for production and approval before installation at the first festival. Prior to kicking off the design process, Gadeken purchased the parts—steel plate of varying thickness and strength—and Holmes provided careful calculations for the unconventional connections needed to hold them together. This collaboration resulted in a safe design and a stimulating art experience for festival attendees. You can find out more about ENTWINED at [www.charlesgadeken.com/entwined](http://www.charlesgadeken.com/entwined). ■