

structurally
sound

PRECISION CLUSTER



AT FIRST GLANCE, *Firmamento* seems chaotic and random.

But it's not. The sculpture, located at the new Tornillo-Guadalupe Port of Entry on the U.S.-Mexico border a few miles southeast of El Paso, Texas, was based on a repeating module: a tetrahedron. Designed by architect Mana, Inc., structural engineer EndreStudio and artist Simparch—and built with HSS—the assembly consists of 29 unique node types and 14 unique pipe lengths, for a total of 230 nodes and 912 pipes. Adorned with 250 rear-view mirrors that change the sculpture's appearance throughout the day, it occupies 800 sq. ft of space and is 26 ft tall.

In addition to the artist's aesthetic requirements, a rigorous structural evaluation of the three-dimensional geometry was performed during the design process. Digital structural modeling was used to seamlessly transfer forces from the refined triangulated geometry through the tilted legs to the ground. A balance of module size, pipe size and system complexity had to be achieved to develop the effect of a cohesive and interconnected mass.

A kit-of-parts strategy was used, which facilitated on-site fabrication, and the modularity and ease of assembly played critical roles during assembly on a busy construction site that included multiple adjacent facilities being built simultaneously. ■