

## Sculpture honors miners

Cliff Billington

The Dream is a precast concrete sculpture of a young girl's head on the site of a former coal mine near St. Helens in Lancashire, U.K. Created by world-renowned Spanish artist Jaume Plensa, it serves as a memorial to the miners who worked at the site.

The sculpture stands more than 20 m (66 ft) high and consists of 13 layers of concrete, each 1.5 m (4.9 ft) high, with a final capping piece at the top. Each layer consists of four separate pieces, weighing an average of 9 tonnes (10 tons) each. The total weight of the statue and the base is 373 tonnes (411 tons).

Because of the statue's exposure to winds of up to 45 m/s (148 ft/s), all of the elements were connected to form a single monolithic structure. Engineers Arup and Partners' design required a connection force of 200 kN (45 kip) between adjacent elements, both horizontally and vertically.

Connection specialist J&P Building Systems was called in to advise on the project in early 2008 because of the company's expertise in working with precast concrete. Early discussions took place with Arup and Partners to investigate possibilities for connections.

About six months later, J&P began detail work on the connections, creating a complex three-dimensional (3-D) digital model in place of drawings. This model, created from Arup's 1-m-high (3.3 ft) scale model of the statue, allowed J&P to position the various connecting inserts.

At first, J&P had intended to use Pfeifer wall shoes to connect both horizontal and vertical joints. However, the embedment length of the wall shoes is about 700 mm (28 in.), and using them for the vertical joints resulted in clashes with the outer surface. As a result, J&P opted to use Pfeifer VS-Plus boxes, a system of wire rope loops that interconnect and have a reinforcing bar passing through them.

Although they are more commonly used for connecting precast concrete walls, the VS-Plus boxes offered considerable tolerance and ease of use in constructing The Dream. The wall shoes were retained for the horizontal joints.

Working only from the Arup model, J&P had to design and then model the position of all of the connections to ensure that there were no clashes with other inserts or with the extremely irregular outer profile.

Using this raw data, J&P produced 3-D information that allowed the mold manufacturer, Cordek, to program the com-



The statue The Dream opened in 2009 near St. Helens in Lancashire, U.K. Photo courtesy of J&P Building Systems.

puter-controlled milling machines to create recesses in the polystyrene molds for the inserts. In addition, working from the 3-D data, J&P produced more-traditional two-dimensional AutoCAD drawings to allow the precaster, Evans Concrete, to position the wall shoes in the flat mold faces.

The statue was officially opened on May 31, 2009.

### About the Author

Cliff Billington is the J&P Building Systems technical director. 