



## Walsh takes the Headaches out of Mass Pours

The Walsh Group combined a performance-based mass pour specification with the latest in wireless *intelliRock* technology to streamline their mass concrete procedures, reduce costs, and improve safety on the jobsite.



**Allegheny River Bridge** Rendering Courtesy of FIGG, Engineer of Record – The new \$190 million Allegheny River Bridge spans require 50,000 CY of concrete, along with hundreds of temperature sensors to ensure a highly durable final product with a long service life.

### The Situation

The Pennsylvania Turnpike Commission's I-76 bridge over the Allegheny River is located in Cheswick, approximately 14 miles northeast of Pittsburgh. The existing steel truss bridge opened in December of 1951 and currently has a four-lane capacity. The bridge is being replaced as part of the Turnpike's goals to improve the durability, safety, and capacity of three miles of roadway between the Pa. Route 28 overpass and the Oakmont Service Plaza. The 2,350-ft-long twin replacement bridges will provide a total capacity of six lanes, three in each direction.

The new twin span structures were designed by FIGG Bridge Engineers and are the first of their type in the state. Construction of the bridges began by using cast-in-place box girders, first built as balanced cantilevers and subsequently post-tensioned.

### The Challenge

Construction of the Allegheny Bridges requires numerous placements that are considered to be *mass concrete pours*. Each mass concrete placement is continually monitored in order to ensure temperature specifications are met. The thermal specifications are in place to assure a durable structure by minimizing thermally-induced cracking and the risk of future damage from DEF.

The thermal specifications on the Allegheny Bridge project differ substantially from those on most projects, which specify a fixed 35°F temperature gradient. To improve workflow, contractor Walsh Construction turned to industry mass-pour expert John Gajda of the CTLGroup for a performance-based thermal control plan that would "take the 'mass concrete' out of the mass concrete." Gajda accomplished this by calculating the in-place strength required to overcome the thermally induced stresses during curing. The calculations

took into account the geometry and constraints of the placement as well as the key properties of the concrete mix design and materials such as the thermal coefficient of expansion of the aggregate. On the jobsite, the in-place concrete strength is determined over time by using intelliRock maturity loggers. As the indicated strength increases, the thermal gradient limitation is relaxed according to the allowances in the performance-based specification. "This process substantially reduces the many burdens of constructing mass concrete placements" says Gajda. "Using a performance-based thermal plan expedited the removal of thermal protection, reduced the demand on our staff during data collection, and built confidence in the owner that we were being aggressive, doing quality work, and pushing the schedule," states Eric Hayes, Assistant Project Manager for Walsh. "In fact, the performance-based plan safely reduced temperature monitoring and protection requirements from what would have been weeks with a traditional fixed-gradient specification to as little as four days."

Although the Allegheny Bridge thermal specifications were a huge step forward for productivity, the requirements to monitor nearly 1000 temperature and maturity (strength) sensors during the job could have been a daunting task. "We have over 50 mass concrete placements and each one usually requires at least six sensors," says Hayes. "The sensors are spread over a couple thousand feet and two river channels. Many are difficult to access and pose safety concerns when downloading data. Reading sensors manually was costing a Walsh engineer an hour and a half each time a set of readings was required – which was a frequent as every six hours and included nights and weekends." There had to be a better way.

## The Solution

With the performance-based mass concrete in hand, and intelliRock loggers in the concrete, Walsh used the new wireless data transmission system to overcome the data collection challenges. The intelliRock wireless system collects data from sensors in the concrete and transmits them in real-time to a base station and computer in the jobsite trailer. Hayes notes, "The turnpike authority and Figg are comfortable with the intelliRock system. The temperature and strength data are transmitted to us in the jobsite trailer and we can immediately forward the readings via email."

## The Results

- The CTLGroup-engineered thermal control plan:
  - Decreased thermal control procedures from 14 or more to as little as 4 days
  - Expedited removal of thermal control equipment, curing protection and formwork
  - Reduced demands required for thermal monitoring and reporting
- The intelliRock system including the wireless accessories used on the job:
  - Monitored and transmitted temperature data wirelessly saving 1½ engineer-hours on every set of readings
  - Eliminated safety concerns during data collection
  - Reported the concrete strength in real-time thereby accelerating workflow



**intelliRock Wireless System (from left to right)** laptop with intelliRock software and radio, reader and sensor, intelliRock wireless remote unit with eight logger connections.

*"Reading sensors manually every time we wanted a reading was costing an engineer an hour and a half. Now the readings automatically download to the computer in the jobsite trailer."*

- **Eric Hayes, Assistant Project Manager, The Walsh Group**