



## Case Study: University of Arkansas Harmon Avenue Parking Facility



**The initial driver for adopting the IntelliRock system on this \$30 million, nine-level, multiple access parking facility was to enhance the project's critical path. But on the first elevated deck pour, IntelliRock revealed that the concrete delivered did not meet the specifications. These deck sections were removed and replaced, setting the job back over 30 days. Using IntelliRock removed an average of a day or more of curing "wait time" from each concrete placement, helping recapture half of the time lost.**

### **Project Background**

The University of Arkansas Harmon Parking Facility project started in March 2003. The first concrete was placed during January 2004 and the last concrete was placed on April 22, 2005. The facility provides 2149 parking spaces.

The general contractor was Baldwin & Shell. During the fall of 2003, Ted Grumbine, Senior Project Manager for Baldwin & Shell, approached Rick Hamilton, Construction Coordinator for Facilities Management at the University of Arkansas, about the possibility of using the IntelliRock system on the \$30 million parking structure project. Grumbine, an architect by training, knew of the IntelliRock system from its use on the Interstate 40 emergency bridge repair project that occurred during the summer of 2002 – ENR August 2002 ([http://www.intellirock.com/resources/case\\_studies/I-40%20Case%20Study.pdf](http://www.intellirock.com/resources/case_studies/I-40%20Case%20Study.pdf)).

Hamilton's initial reaction toward IntelliRock was skepticism. A construction manager with a background in construction inspection and materials testing, Hamilton had witnessed several new technologies that failed to live up to their claims.

To discuss the possible use of IntelliRock on the project, a meeting was held with the key participants including: Mr. Grumbine, Mr. Hamilton, consulting engineer Mr. James Beatty, P.E. Principal of I.C.E., and Mr. Mark Barton, P.E. and Vice-President of Grubbs, Hoskyn, Barton & Wyatt, Inc. – the testing laboratory, and Mr. Richard Sallee Vice-President of Engiuis, the manufacturer of the IntelliRock system.

During this meeting, the additional advantages of the IntelliRock system were explained. The initial

### **Quick Facts:**

**Project:** \$30 million, nine-level parking garage – 2149 spaces  
**Owner:** University of Arkansas, (Fayetteville, AR)  
**General Contractor:** Baldwin & Shell (Little Rock, AR)  
**Consulting Engineers:** I.C.E. (Little Rock, AR) Walker Parking Consultants (Houston, TX)  
**Architect:** Polk, Stanley, Rowland, Curzon & Porter (Little Rock, AR)  
**Lab:** Grubbs, Hoskyn, Barton & Wyatt, Inc., (Springdale, AR).  
**Concrete Sub:** Cantera - Manhattan Construction (Tulsa, OK)  
**Concrete Provider:** Central Redi-Mix (Springdale, AR)

motivation for using the system was to enhance the project's critical path. In addition, IntelliRock also enhanced the Quality Control (QC) and Quality Assurance (QA) initiatives of the project, challenging tasks due to the weather extremes of northwest Arkansas - hot summers and cold winters.

### **IntelliRock**

The IntelliRock system uses an embedded sensor to measure temperature and calculate concrete maturity in real time with *no permanently affixed external devices*. The sensor (or "logger") is placed into the concrete structure at the time of placement and then activated using a handheld reader. The reader is then disconnected, leaving only 18-gauge lead wires protruding from the concrete. Whenever a strength measurement is desired, the handheld reader easily connects to the leads and the current maturity and associated temperature is displayed. In addition, a history of temperature and maturity values, and the time-stamped minimum and maximum temperatures are displayed. Sensor data is downloadable to a personal computer in a secure, unalterable format.

"During the construction phase the IntelliRock system proved its worth by supplementing the construction efforts in each of these ways – the critical path, QC and QA," said Richard Welcher, P.E. Project Engineer, CMT Project Manager. "Plus

the system produces in-situ data that is both unalterable and uninterrupted.”

This project was a post tensioning (PT) job. Knowing when to pull the PT tendons and when to safely remove the form work were critical factors, particularly since there were several weeks of colder than normal weather during the winter of 2004 and spring of 2005. The deck pours were relatively large, often exceeding 700 cubic yards of concrete. On a placement of that size, between five and seven sensors were used. An advantage of the IntelliRock system is that sensor placement can occur at specific locations where the determination of strength is critical, such as near PT cables, inside beams or other locations.

### Quality Control

The QC benefits of IntelliRock were experienced on the first elevated deck pour. Welcher noticed that the concrete delivered did not seem to meet the specifications. The IntelliRock sensors confirmed this suspicion, indicating extremely low maturity readings compared to pre-construction calibration curve [ASTM C 1074]. These deck sections were subsequently removed, setting the job back over 30 days. The root cause of the problem was traced to the batch plant which had performed some recalibration the previous night. The calibration scale company inadvertently severed a wire to the cement scale. Consequently, cement weights were far off from the specified mix. The valuable QC data the IntelliRock system provided served the project well, allowing early detection of the mix problem. Mr. Stacy Prince, Quality Assurance Manager for Central Redi-Mix concluded “The IntelliRock system is the most dependable and accurate means of gauging the curing of concrete I have come across. This system seems immune to many of the known factors, such as weather and testing issues, which result in inaccurate strength results. Once a calibration curve has been established with a mixture you have totally reliable and accurate values to utilize for form removal and structure loading.”

### Quality Assurance

The value of IntelliRock as a QA solution was proven on the project as well. During colder weather months there were instances where lab-cured test cylinders indicated that the concrete had attained its strength. However, IntelliRock sensors within the placement revealed that it had not yet attained the strength necessary to proceed to the next phase of construction. The project did not proceed until the IntelliRock sensors indicated the necessary strength had been realized. This dramatically reduced the risk of over stressing and damaging the green

concrete from the post tension cables. More importantly, the IntelliRock sensor data prevented premature removal of forms, enhancing project safety. “We considered it imperative that the sensor validation protocol be adhered to,” said Hamilton.

### Critical Path

The mix quality problem on this project caused an expensive 31-day delay. Even with good management practices redirecting work efforts to other areas, the net delay to the entire project was reduced to 16 days. Using the IntelliRock system helped recapture an average of a day or more of curing “wait time” from each concrete placement, an indispensable schedule recovery tool.

In addition to saving valuable construction days, IntelliRock also accelerated the critical path for activities that required strength documentation of the in-place concrete before proceeding. “This really helps the total work flow of the project,” stated Hamilton.

Within a short time, the principals on the project became comfortable with the performance and consistency of the IntelliRock system. The inspecting engineer approved the system’s use to predict when strength would be attained and thus to press the construction schedule.

“The system did a wonderful job for what it is designed to do and I would not hesitate to use it again,” concluded Grumbine.

“The IntelliRock system provides an excellent informational and monitoring tool, as well as providing an element of safety we never had previously. I would expect the University of Arkansas to use it for all our multi-story projects,” said Hamilton.

