

2009 Outstanding Infrastructure Project

The Dan Ryan Expressway

The Dan Ryan Expressway runs from the Circle Interchange of downtown Chicago through the south side of the city and totals 11.5 mi (5.22 km). In 2006 and 2007, the Illinois Department of Transportation (DOT) reconstructed the entire length of the Dan Ryan Expressway, including the addition of a travel lane. The project was the most massive expressway reconstruction plan in Chicago's history. In 2008, the focus was now on the reconstruction of 120 piers that supported 2.5 mi (4.17 km) of expressway that were previously repaired in 1988 and 1989 using formed concrete.

Shotcrete Challenge

The repairs began in September of 2008 while starting at the southern end of the project. American Concrete Restorations (ACR) was contracted to repair the substructure following the Illinois DOT's Structural Repair of Concrete Specification. The specification gives the contractor the choice of formed concrete repair or shotcrete. The use of shotcrete over the form-and-pour method was chosen partly for its advantages in "green building." The use of shotcrete eliminated the use of lumber, including approximately 400 sheets of plywood: 5000 linear ft (1524 m),



Underneath view of one of the largest and busiest expressways in Chicago, IL



Use of shotcrete over form and pour was chosen for its advantages in "green building"



This elevated structure runs through the heart of the city of Chicago



120 piers approximately 60 ft (18.28 m) high above local roads, businesses, and railways

2 x 4 in. (50.8 x 101.6 mm); and 5000 linear ft (1524 m), 2 x 6 in. (50.8 x 152.4 mm). It also eliminated the energy to manufacture, transport, install, and dispose of these materials at the end of the project. In addition, the use of recyclable bulk bags saved on waste and disposal of paper bags and/or excess ready mix. With the use of shotcrete, ACR was able to deliver a fresh material on a consistent basis to properly encase the reinforcing steel while touching the material only once and not having to revisit the areas to strip forms, fill holes, and grind. The bridge was elevated approximately 60 ft (18.28 m) above numerous local roads, businesses, and railways within an overpopulated area of Chicago known as Chinatown. The use of shotcrete also eliminated a safety factor of not dropping plywood, coil rods, and small tools from these heights.



A 60 ft (18.28 m) boom lift was used to access piers

Plan of Attack

The 60 ft (18.28 m) tall boom lifts were brought in to begin removal; however, as concrete removal started, it was immediately recognized that the project was going to exceed initial contract quantities. This required evaluation and authorization by the owner. Because the areas in need of repair were so extensive, the owner decided to repair only the pier caps at this time.

A quick response from the owner was received and the additional quantities were approved. The owner's decision to repair only the pier caps, however, also brought concern to remove them in their entirety. The owner suggested the use of shoring to help support the structure. ACR, on the other hand, suggested an alternative procedure that was successfully used on other state projects where the caps are completed in segments. It includes the pier cap being repaired in halves, where one area is removed and replaced and, after the shotcrete reaches 75% of its strength, the other half is completed (and so on). The owner was satisfied with the procedure as it was to be done in lieu of shoring and would provide a cost savings to the state of Illinois. After the procedure was approved, the concrete removal was set in motion at numerous piers. The concrete was removed past the first mat of steel while saw cutting the edges and sandblasting using abrasive grit, taking great care to blast the saw-cut edges that get polished with the saw cut. Black reinforcing bar was supplemented as necessary and the entire prepared area was inspected by the engineer for approval.



Over 15,000 lb (6803.8 kg) of reinforcement was supplemented

Shotcrete Solution

All of the shotcrete work was done from the ground and was pumped 60 ft (18.28 m) upward to the nozzle. ACR used prebagged materials. The water was hauled on site using 250 gal. (946.4 L) totes; the temperature was monitored. The use of



All shotcrete work was done from the ground and pumped upward to the nozzle



Completed by American Concrete Institute (ACI) Certified Nozzlemen



Cured with wet cotton mats for 7 days



11,000 ft³ (311.4 m³) of removal and replacement



Zero accidents!

hot water in tote tanks in cool weather and the use of ice in warmer weather kept the material temperature consistent between 70 and 78°F (21.1 and 25.5°C). In addition, the use of canopies over the material and a shotcrete pump aided in temperature control during the summer months, whereas concrete blankets and heaters helped moderate the material temperature in autumn.

The freshly sandblasted surface (within 72 hours of shotcrete placement by specification) was prewet to a saturated surface-dry condition. The shotcrete was placed with a 0.42 water-cement ratio, along with the addition of 10% by weight of 0.375 in. (9.5 mm) river rock. All of the work was completed by ACI Certified Nozzlemen. The curing was done with cotton mats attached to the pier with 1 x 2 in. (25.4 x 50.8 mm) studs and interspersed with heavy-duty soaker hoses and were gravity fed with water for 7 days. After 7 days of wet curing, the mats were removed and the structures were sounded by the engineer for acceptance.

Phase I (South end) was completed mid-November 2008 and Phase II (North end) was completed on July 15, 2009. The scope of work resulted in over 11,000 ft³ (311.4 m³) of removal and replacement with high-quality shotcrete. The General Contractor and ACR are also proud of their safety record of zero accident reports while working 60 ft (18.28 m) in the air. All of the test results exceeded the specification's requirement. The shotcrete solution resulted in a long-term, affordable repair.

The Outstanding Infrastructure Project

Project Name
Dan Ryan Expressway

Project Location
Chicago, IL

Shotcrete Contractor
American Concrete Restorations, Inc.*

General Contractor
Illinois Constructors

Architect/Engineer
Illinois Department of Transportation

Material Supplier/Manufacturer
Spec Mix, Inc.,
as manufactured by Packaged Concrete*

Project Owner
Illinois Department of Transportation

*Corporate Member of the
American Shotcrete Association