2014 Outstanding Repair & Rehabilitation Project

The 606-Bloomingdale Trail | Viaduct Repairs

By Kevin Doyle

Located on the northwest side of Chicago, IL, the abandoned railway known as the Bloomingdale Line, originally constructed in 1873, runs east and west through four dense neighborhoods including Bucktown, Logan Square, Wicker Park, and Humboldt Park. The line starts at the Kennedy expressway, just north of the loop, half way between Wrigley Field and US Cellular Field, and heads west for 2.67 miles (4.29 km). The line was built shortly after the Chicago fire in 1871 by Chicago and Pacific Railroad to connect outlying rail ports to the Chicago River and to help support the city's expanding industrial sector. Due to a high number of accidents involving trains and residents all over the city in the late 1800s, the city passed an ordinance mandating that all rail lines in the city be elevated and, in 1910, the Bloomingdale Line was raised to 15 ft (4.6 m) above street level.

Use of the line greatly reduced in the 1980s and train service was eventually rerouted to other rail lines. By the mid-1990s, all rail activity ceased, creating an ideal platform for an elevated rails-to-trails conversion. The out-of-service rail line was largely left alone and reclaimed by wildlife and plants. The idea for "The 606" has its origins in the CitySpace Plan of 1998, which showed the Logan Square community area did not meet minimum standards for open space per capita. In fact, of the 77 community areas, it ranked second to last at 99 acres (40 ha) deficient for the population. In 2004, the City of Chicago adopted the Logan Square Open Space Plan, which helped identify ways to increase open space to achieve the minimum standards. The Bloomingdale Line was called out as a way to provide open space in an otherwise dense and built-out community.

The City of Chicago and the Chicago Park District, with the support of local residents and The Trust for Public Land, proposed to officially repurpose the elevated tracks into a 2.67 mile (4.29 km) long recreational trail for biking, running, and walking. "The 606" refers to the park and trail system that is currently under construction, the centerpiece of which is the Bloomingdale Trail. "The 606" gets its name from the zip code prefix, 606, which all Chicagoans share; the Bloomingdale Trail is named for the street right-of-way where the trail is located. The proposal encompassed structural concrete repair and rehabilitation work of 36 concrete bridges and retaining walls, landscaping, bridge deck waterproofing, new bridge construction, decorative guardrail, new lighting and security cameras, the creation of new parks, and installation of numerous access ramps along the length of the trail.

The project was let out to bid early May 2013, bid late in May 2013, and awarded shortly thereafter, demonstrating the urgency the City had to get this project under way. American Concrete Restorations (ACR) was contracted to repair the bridges and retaining walls following the Chicago Department of Transportation Structural Repair of Concrete Specification, which gives the contractor a choice of formed concrete repair or shotcrete. Due to the need for extensive coordination with the surrounding communities, ACR was finally called upon to begin work in late October 2013.

With frost already present and frigid cold temperatures soon to be upon Chicagoland, ACR devised a plan to keep the project moving forward through the winter months. This plan consisted of performing the necessary concrete removals at the bridge locations followed by fully enclosing and heating the structures for shotcrete work to proceed. Along with a late start in the year and the cold weather setting in quickly, this project had a variety of obstacles, including access into heavily congested neighborhoods and residents' properties, repairs during limited closures of main thoroughfares, and a structure that was in much worse shape than originally anticipated (Fig. 1).

Shotcrete Segment of Project Overview

The shotcrete portion of "The 606" was located at each of the 36 bridges and also the retaining walls and caps that spanned the 2.67 miles (4.29 km) of the project on the north and south sides of the trail. Work at the bridge locations encompassed the entire substructure including the wing walls, abutments, columns, and parapets. Each of the 36 bridges crossed two-lane streets, had three piers, and 15 columns. The trail also crossed five arterial streets, each with four lanes of traffic. At these locations there were four piers and 20 columns. At the longest bridge crossing, Humboldt Park Boulevard, it crossed six lanes of traffic, and there were 11 piers and 33 columns (Fig. 2).

Challenges

Upon commencement of the project, ACR realized that the bridges were in far worse condition than shown on the plans. Quantities immediately began increasing, as did the depths of the repairs, due to the fact that these walls were constructed with 1 in. (25 mm) unwashed river rock aggregate and without reinforcing steel. It was imperative to maintain excellent communication with the general contractor and the owner's engineers to verify work to be done and any additional repair steps to be taken, such as the addition of reinforcing bar, shoring, and identifying areas of complete deterioration requiring full replacement.

Because all the bridges are in close proximity to residences, schools, daycare centers, parks, dog parks, small businesses, and main thoroughfares, some special precautions had to be taken to protect private property and also to protect the heavy pedestrian and motor traffic that travelled through these areas. Along this 2.67 mile (4.29 km) jobsite, ACR encountered numerous neighborhoods encompassing various demographics. Many work zones were located adjacent to schools, requiring ACR to use extreme caution when conducting repairs and moving machinery in close proximity to young children who are often unaware of their surroundings and the dangers of a construction zone.

Due to the congestion of the work area and the proximity to neighboring homes, parks, and schools, ACR sandblasted with water to keep dust to a minimum. ACR also cleaned up their work area at the end of every day to prework conditions, thus leaving the neighborhood safe for pedestrians and vehicle traffic (Fig. 3).

As the bridges provided the only means of travel for residents from one side of the trail to the other, ACR had to phase its work at the bridge locations, keeping one lane of traffic and one sidewalk open at all times.

ACR encountered both winter and summer conditions during the course of the project. This change in environment called for different approaches to quality control. When starting the project in late October, the cold temperatures of the infamous 2013-2014 Chicago winter were

Fig. 1: Repair areas were found to be not only much larger in the field but also deeper than was called out on the plans and also lacking any reinforcing bar

Fig. 2: Repaired 11 piers spanning 250 ft (76.2 m) over six lanes of traffic

Fig. 3: Repairs completed at a newly installed pedestrian access ramps

already setting in. ACR devised a comprehensive plan for dealing with the upcoming winter months to accommodate low temperatures of up to –40°F (–40°C) wind chill temperatures. Each bridge was wholly enclosed using heavy-duty, fire-retardant tarps (Fig. 4 through 6). ACR also deployed large propane heaters to ensure proper ambient and substrate temperatures. Where full road closures were necessary, ACR was allowed a maximum of 2 weeks to complete the work on the specific bridge, including 7 days for curing, to satisfy the restrictions of the City of Chicago permits for street closures. ACR also used heaters to keep the water warm for mixing and torpedo heaters to warm the skids of pre-bagged material and the staging area. ACR used both infrared and standard thermometers to confirm the temperature of the substrate, water, pre-bagged material, and mixed material stayed at or above the specified minimum temperatures. The temperatures were recorded on quality control checklists every hour to document ACR's ability to maintain a high-quality shotcrete mixture. ACR's plan succeeded in providing quality repairs while allowing the project to progress through the brutal Chicago winter.

Upon the arrival of the hot summer months, ACR had to pay special attention to make sure the shotcrete mixture remained at satisfactory maximum temperatures. To maintain the temperatures required in the specifications, ACR replaced the water supply midday with fresh cold water or added ice to the water supply containers. When possible, ACR's staging area along with the pre-bagged skids of material were set on the North side of the bridge next to the retaining wall to decrease the amount and duration of direct sun exposure. If this was not possible, canopies erected over the material and shotcrete pump provided shade to aid in temperature control. Similar to the winter months, ACR used infrared and standard thermometers to verify the temperature of the substrate, water, pre-bagged material, and mixed material to ensure they stayed below the specified maximum temperatures. The

Fig. 4: Heated enclosures were installed on portions of bridge during winter months

Fig. 5: Large propane heaters kept temperatures inside enclosure within specifications during cold winter months

Fig. 6: Shotcrete placement inside a heated bridge enclosure

temperatures were also recorded on quality control checklists every hour.

The retaining walls posed an entirely different set of challenges. The walls ran the entire 2.67 miles (4.29 km) length of the trail between the bridges on both sides of the trail. Many of these walls were located in the backyards of residents and some of the houses were very close to the walls, at times separated only by a 4 to 5 ft (1.22 to 1.5 m) pathway. ACR had to coordinate with the general contractor and owner's engineers on a daily basis to ensure that the residents permitted ACR adequate access to their yards to perform the work. In addition, some of these homes maintained elaborate gardens and expensive landscaping, requiring specialized property protection.

Specifically, one of the yards ACR needed to access housed a picturesque koi pond and an herb garden owned by a well-known chef. This garden is closely tended by a professional gardener, and the harvest is used in several restaurants (Fig. 7). Thus, ACR had to deploy multiple levels of protection for the plants and planters from dust, debris, and overspray. Further, the retaining wall next to this garden was covered in decorative vines, and ACR had to coordinate with the chef's gardener to ensure proper pruning or removal without unnecessary damage to the surrounding foliage. In other areas, ACR had to install temporary framing on the outer edge coupled with protective mesh and tarps to ensure that the shotcrete work was not damaging homes and yards. ACR also encountered an area of retaining wall where the cap was directly above a residential balcony. To perform removals and shotcrete repairs without damaging property below, two stages of protection were deployed. First, ACR installed a fabric tarp along the guardrail of the trail to keep debris from travelling over the side. Additionally, the area designated for repair was framed to ensure that all chipping debris would remain on the trail-side instead of falling to the balcony and property below. This one-sided formwork also gave the nozzleman something to shoot against. As ACR progressed along this 2.67 mile (4.29 km) jobsite, encountering different temperaments of residents, gaining permission to access the repair areas along the retaining walls ran the spectrum of difficulty.

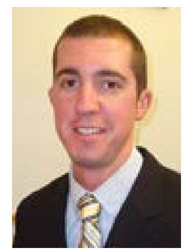
Significance to Project

When compared to form-and-place repair techniques, shotcrete proved a far more efficient method of repair on the 36 bridges and miles of retaining walls that allowed for quicker completion with excellent structural capability. As in all construction projects, time was of the essence. Many of the bridges required the erection of shoring towers simply to stabilize a severely

Fig. 7: Elaborate gardens of homeowners required covered repair areas that needed thorough planning, preparation, and coordination

deteriorated substructure and required them to be in place until the specified 14-day compressive strength tests of the shotcrete was met. The use of shotcrete and its versatility had many advantages over form-and-place. One advantage was the ability to remove the shoring towers long before the 14-day compressive strength requirement when the pre-bagged shotcrete material reached 70% of its strength. This allowed for reopening the streets in compliance with the City of Chicago's permit requirements. Another advantage in using shotcrete was repairing the retaining walls adjacent to private backyards, including that of a well-known chef. ACR staged the shotcrete equipment on the opposite side of the trail and ran the shotcrete hoses up and over the trail as opposed to through the yard and gardens. In addition, this set-up eliminated the need for tradesmen to access the yards to set-up and strip formwork for a form-and-place operation, thus completely preventing the damage or inconvenience that access could create. Using the shotcrete method also meant that there was no possibility of a form blowing out during casting and damaging the yard. The shotcrete process also allows a visual confirmation of encapsulation of the reinforcing bar throughout the shotcrete placement process, while cast-in-place work requires casting into a closed form where incomplete consolidation and resulting voids aren't evident until stripping the forms. After the shotcrete was placed, a double layer of curing compound was applied, thus eliminating the need to impede on private property for any form removal, grinding, or patching.

The scope of work resulted in over 15,000 ft^3 (425 m^3) of removal and replacement with high-quality shotcrete. All the shotcrete was placed by ACI-certified Nozzlemen employed by a qualified shotcrete contractor. The shotcrete was placed with a 0.42 water-cementitious materials ratio, along with the addition of 10% by weight of 3/8 in. (10 mm) river rock. Safety, time, and quality all significantly contributed to the very successful use of shotcrete by the Chicago Department of Transportation (CDOT) on "The 606" project. The general contractor and the subcontractor are also proud of their safety record of zero accident reports while working in one of the most congested parts of the city. All work was done to OSHA regulations and CDOT environmental requirements. All of the compressive strength test results exceeded the specification's requirement and the shotcrete solution resulted in a long-term, affordable repair with minimum impact on the surrounding community.



***Kevin Doyle** graduated from The Ohio State University in 2009 with a bachelor's degree in construction management. Having worked for a privately owned government contractor out of college, Doyle gained the experience from the owner's perspective that would prove valuable once he joined American Concrete Restorations, Inc., in April 2013. Doyle brought his understanding of the necessity for strong communication and teamwork between a contractor and owner to this project and helped to ensure project progress remained on track. "The 606"-Bloomingdale Trail is his first major project in which he helped manage, and thus Doyle is extremely proud that it has been awarded ASA's 2014 Outstanding Repair and Rehabilitation Project.*

The Outstanding Repair & Rehabilitation Project

Project Name
606-Bloomingdale Trail | Viaduct Repairs

Project Location
Chicago, IL

Shotcrete Contractor
American Concrete Restorations, Inc.*

General Contractor
Walsh Construction

Architect/Engineer
Transystems

Material Supplier/Manufacturer
SPEC MIX*, Putzmeister Shotcrete Technology*

Project Owner
City of Chicago—Department of Transportation

*Corporate Member of the American Shotcrete Association