

WATER RESOURCES

Arc-Shaped RCC Spillway Triumphs in Dam Rehab

Gregg W. Hudock, P.E. Golder Associates Inc.

A roller-compacted concrete (RCC) spillway proved the most cost-effective method of bringing an aging flood-control dam into compliance with modern safety standards.

Constructed in 1967, the Yellow River Watershed Dam No. 14 (Y-14) resides approximately 30 miles (48 km) northeast of downtown Atlanta near the city of Lawrenceville in Gwinnett County, Georgia. The dam was built as part of the Soil Conservation Service Resource Conservation and Development Program. Originally constructed to protect pasture and farmland, the dam now protects subdivisions, apartment complexes, office parks and retail businesses in a rapidly growing Atlanta suburb. The watershed area is approximately 3.1 square miles (8.0 km²). The original height of the dam was 40 feet (12.2 m). The structure was constructed with a two-stage principal spillway riser and pipe outlet and a 50-foot-wide (15.2 m) earthen auxiliary spillway located east of the dam site.

When officials found that the dam was not in compliance with current Georgia rules for dam safety, they analyzed options for modernizing the structure. The most cost-effective solution was construction of an RCC spillway overtopping the existing dam and abandonment of the existing earthen spillway. The RCC spillway crest was set at an elevation of 1.5 feet (0.5 m) below the existing earthen spillway crest. This elevation is approximately 1.2 in. (30 mm) above the 100-year 24-hour storm, so as to not impact the FEMA mapped floodplain downstream of the structure.

Golder Associates Inc. designed an arc-shaped chute spillway with an ogee weir. This design minimized convergence impacts and provided favorable hydraulic performance with uniform streamlines, preventing the formation of supercritical waves that could potentially overtop the chute walls. The arc-shaped spillway also minimized excavation, encroachment on adjacent properties, and tree removal in the downstream abutments.

The RCC spillway steps were constructed by forming the front edge of the 1-foot-high (0.3 m), 10-foot-wide (3.0 m) steps. The chute steps were constructed with a 3H:1V slope; the



Y-14 Structure during the early stages of construction (clearing and grubbing in process)



Placement of the first lift of RCC in the stilling basin area at the toe of the existing dam



Construction of spillway chute steps and stilling basin training walls

training wall steps were constructed with a 2H:1V slope. The spillway's arc shape was formed using 10-foot-long (3.0 m) connected concrete forms. Bedding mix was required on the first four lifts, last two lifts, and on every cold joint having a joint maturity greater than 2000 °F-hours.

The contractor completed RCC placement in five weeks at a cost of \$1.33 million. The average price of constructed RCC (including cement and pozzolan) was \$142/yd³ (\$186/m³). Approximately 4,650 cubic yards of RCC were placed.

The new RCC spillway safely routes the full Probable Maximum Precipitation (PMP) storm through the watershed, with a peak discharge capacity of approximately 16,000 ft³/sec (453 m³/sec) and maintains the peak storm stage below the original dam crest elevation. Sixty-five percent of the total project costs were funded by the Natural Resources Conservation Service (NRCS) Watershed Rehabilitation Program.



Close-up view of RCC steps

Vital Statistics

Remediation Features

Maximum height of embankment	40 feet (12.2 m)
Overall length of dam	280 feet (85.3 m)
Width of arched RCC spillway at crest	190 feet (57.9 m)
Width of arched RCC spillway at downstream end	82 feet (25 m)
Height of RCC spillway steps	12 inches (305 mm)
Width of RCC spillway steps	10 feet (3 m)
Slope of chute steps	3H:1V
Slope of training wall steps	2H:1V

RCC Mix Design

Type I portland cement	250 lb/yd ³ (148 kg/m ³)
Class C fly ash	250 lb/yd ³ (148 kg/m ³)
Graded road base aggregate (1-1/2" (37.5 mm) MSA)	3,273 lb/yd ³ (1945 kg/m ³)
Moisture content	6.7 percent
Specified compressive strength at 28 days	3000 psi (20.7 MPa)



Completed RCC structure

Credits

Owner/Construction Manager: Gwinnett County, Georgia

Federal Sponsor: Natural Resources Conservation Service

Designer/Engineer/QA Testing: Golder Associates Inc., Atlanta, Georgia

RCC mix design: Schnabel Engineering Associates, Inc., Atlanta, Georgia

Contractor: Thalle Construction Company, Inc.



Portland Cement Association

5420 Old Orchard Road
Skokie, Illinois 60077-1083
847.966.6200 Fax 847.966.9781
www.cement.org

An organization of cement companies to improve and extend the uses of portland cement and concrete through market development, engineering, research, education, and public affairs work.