

# The RIGHT Choice

FOR SAFE DAMS

## PROJECT PROFILE

# McKinney Lake Dam

## AN RCC FIRST IN NORTH CAROLINA

The first dam remediation project in North Carolina to use roller compacted concrete (RCC) for overtopping protection.

Originally constructed in the late 1930s as a Works Progress Administration project, the 23-ft-high (7 m) dam consists of an earthfill embankment with a concrete corewall. The principal spillway is located in the middle third of the dam and consists of a concrete gravity overflow section and a rectangular concrete outlet channel. An unlined emergency spillway was cut into the left third of the embankment.

When state officials determined that the dam suffered from safety deficiencies, roller-compacted concrete (RCC) was chosen as the material of choice for improvements. Plans called for increasing spillway capacity and raising the top of the dam.

*McKinney Lake Dam is located on Hitchcock Creek, north of Rockingham, North Carolina. Situated upstream of the McKinney Lake National Fish Hatchery, the dam's primary purpose is to supply water to the facility.*



# The RIGHT Choice

FOR SAFE DAMS

## PROJECT TEAM

**URS Corporation**, Denver, Colorado designed the dam improvements and is the engineer of record.

**Schnabel Engineering Associates** Greensboro, North Carolina, was the project manager responsible for owner and dam safety coordination, as well as construction oversight. Schnabel's Charlotte office performed field and laboratory testing.

**Atlas Resource Management**, Fayetteville, North Carolina, was the general contractor.

**Gears, Inc.**, Crested Butte, Colorado, was the subcontractor for RCC mixing and placement.

**S&ME**, Louisville, Tennessee, performed the RCC mix design.

## REMEDIATED STRUCTURAL FEATURES

Maximum height of embankment . . . . .	23 feet (7m)
Elevation of embankment crest . . . . .	284.9 feet (86.8 m) MSL
Overall length of dam . . . . .	718 feet (219 m)
Control crest width of principal spillway . . . . .	40 feet (12 m)
Control crest elevation of principal spillway . . . . .	277.5 feet (84.6 m) MSL
Upstream slope of embankment . . . . .	2H:1V
Downstream slope of embankment . . . . .	3H:1V
Crest width of emergency spillway . . . . .	240 feet (73 m)
Crest elevation of emergency spillway . . . . .	280.0 feet (85.3 m) MSL

The project's design concept addressed inadequate spillway capacity by armoring a section of the embankment with RCC, and raising the crest of the embankment to contain the 1/3 PMP flood level plus freeboard. The armored section of the embankment serves as the emergency spillway.

The RCC mix design was as follows:

Type I/II portland cement . . . . .	450 lb/yd <sup>3</sup> (204 kg/m <sup>3</sup> )
Modified NCDOT roadbase aggregate (1-1/2 MSA) . . . . .	3,428 lb/yd <sup>3</sup> (1558 kg/m <sup>3</sup> )
Water . . . . .	262 lb/yd <sup>3</sup> (119 kg/m <sup>3</sup> )

The specified 28-day compressive strength was 3,000 psi (20.7 MPa). The unusually high cement content was required to compensate for poor grading of the sand fraction of the NCDOT base course aggregate. In addition the silt fines were on the high side of the specified range (3% to 8% by weight) for minus #200 (75 micron) sieve material.



The 1600 yd<sup>3</sup> (1223 m<sup>3</sup>) of RCC armor was placed on the upper portion of the upstream slope, the crest, the downstream slope, and an apron area beyond the downstream slope. Sheet piling driven along the edges of the RCC serves as spillway training walls to contain the design discharge. The training walls converge to direct outflows up to the projected 100-year flood level through an existing box culvert under the downstream access road. The end result: improvements with RCC increased the spillway discharge capacity to more than 11,000 cfs (311 cms), or about 47 cfs per foot (4.3 cms/m) of weir length—a substantial improvement over the dam's original capacity.



**PCA**  
**Portland Cement Association**  
 5420 Old Orchard Road  
 Skokie, Illinois 60077-1083  
 847.966.6200 Fax 847.966.9781  
 www.cement.org  
 PL460