Schnabel ENGINEERING

1380 Wilmington Pike, Suite 100
West Chester, PA 19382

RCC 2011 Another Successful Seminar and Study Tour

Another successful International Roller Compacted Concrete (RCC) Seminar and Study Tour was held in Atlanta, Georgia, September 12th to the 15th. The program included approximately 90 attendees from 12 different countries. The program was co-sponsored by Schnabel Engineering, ASI Constructors, and Fall Line Testing. Technical presentations and case studies of RCC dam construction were provided by internationally recognized RCC experts, RCC contractors, engineering consultants, and representatives or former employees from the USBR, FERC, US Army Corps, and NRCS. Talks focused on foundation preparation, mix design, cost estimating, spillways, diversions, RCC gravity design, overtopping protection, construction, and newly developed placement techniques. Randy Bass presented Design Details for RCC Gravity Dams and a Case History on Hickory Log Creek. Jimmy Crowder co-presented a presentation on the overtopping of several RCC overtopping protection projects on the Yellow River in Georgia. Tom Fitzgerald presented Design of RCC Overtopping Protection and a case study on Deep Creek Watershed Dam 5D.

The unique program also included a tour of the 188-foot high Hickory Log Creek Dam and a full scale RCC demonstration. ASI set up a pugmill in a local quarry and batched RCC mixes of various consistencies. ASI also brought all equipment and personnel to a demonstrate placement and compaction in a small test section. Some experimentation with grout enriched RCC was practiced, and attendees were given live demonstration of proper cylinder compaction, vebe testing, unit weight, and density with a nuke gage (Marius Sima). Participants were given plenty of opportunity to get dirty and experiment with RCC themselves. A highlight of the conference was a barbeque held at the Schnabel's Alpharetta, Georgia, office after the tour and demonstration. The party included live music, great food and an opportunity for Schnabel to host numerous potential clients and colleagues from around the world. The success of the conference was due to the collaborative effort of many from Schnabel, ASI, Fall Line Testing, and Mr. Ken Hansen.

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Water Wire

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From the Director's Chair

What's Unsafe about Safe Yield

Most folks in the water business are pretty familiar with the concept of reservoir safe yield. It's a time run mass balance model that determines what withdrawal can consistently be taken from a reservoir and not exhaust the supply during the worst drought conditions. The single largest vulnerability to the reliability of the method is the streamflow record used to develop the model. Dave Campbell wrote in the Spring Water Wire issue about the uncertainties of climate and weather patterns, and how we tend to assume that the historic record is a good representation of what we can expect in the future. However, there are other drought uncertainties, some of them actually fairly predictable, that can negatively impact the ability of a reservoir system to supply water to a community.

It's rare that streamflow records go back more than 100 years. That's a fairly limited data set for establishing a fully dependable supply of water for a community. The statistical variability of drought severity related to safe yield can often be demonstrated by examining the output of a safe yield model, as follows: Remove the single "drought of record" and then recalculate the yield. It's not a good thing that you just demonstrated that the adjusted outcome is likely a much larger reliable output. You may be in for a surprise when that drought or a worse one does occur. Just as one can intentionally shift the yield higher by eliminating one pesky drought, it's just as likely that such a drought or worse occurred just before the streamflow data set you are using began or is lurking just around the corner. Tree ring evidence is fairly strong that droughts of a few hundred years ago were substantially more severe and longer lived than for the relatively benign climatic conditions documented over the last 50 to 100 years.

These considerations highlight the complete disconnect that we have in designing spillways vs. how we size water supply reservoirs. Probable maximum precipitation is what theoretically is the worst case flooding scenario for a watershed that must pass through a dam's spillway. Yes, it has been experienced but only rarely. Most engineers familiar with risk assessment are comfortable with designing dams and spillways based on such maximum probabilities.

Guest author Allan Williams takes the chair. Allan is newly on-board with Schnabel after retiring as Director of Water Resources for the City of Greensboro, North Carolina.

There's comfort in a body of knowledge, experience, and technical disciplines that set this bar. Curiously, the same engineering profession is satisfied with the safety of a water supply based on a scant set of data that likely represents no more than 50 to 75 years of experience (probable maximum precipitation may have a return frequency in the hundreds of thousands of years). To add to this overt vulnerability is the expectation that, yes, once in 50 to100 years (depending on the assumptions), the water system will draw out that "last remaining gallon" before the next rain and make decent water out of it before the intake pumps break suction. Any utility that has depleted even 50-70% of its reservoir, especially in systems that do not refill reliably each water year, has most likely experienced both intense heartburn and treatability issues that negatively impact customers and yield. When lakes get low, chemical addition, sludge volume and backwash losses increase, deteriorating the assumed ratio of finished water to raw water. This deterioration is not usually accounted for in water supply planning.

In closing, consider what water supply vulnerability really means. There are well accepted processes to establish the risk of dam failure, the extent of damage, and the loss of life. With this risk in hand, many millions of dollars of capital may be expended to mitigate that risk. Can we be casual about the risk of water supply failure in cities with hundreds of thousands to millions of people dependent upon yield calculations that reflect relatively high probabilities and have no factor of safety? Imagine the impact of a water supply failure lasting for weeks or months. The economic, fire protection and public health impacts are immense. Would people die? Let's hope not. Could the community recover? Let's hope so, but recognize that it would be a long process and the impacts would be devastating.

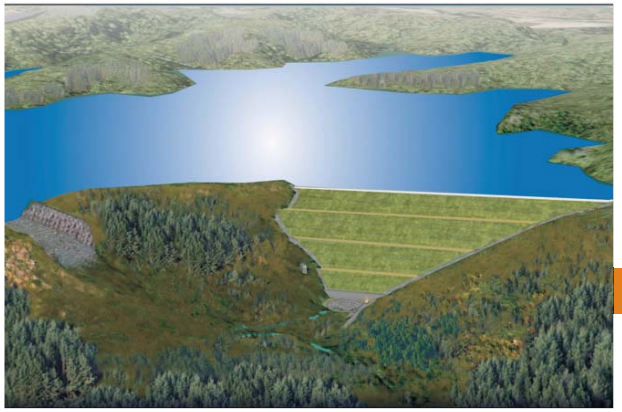
So if anyone is asked, or asks oneself, this is why we need to bring safety factors and risk assessment to water supply planning.

If we set our standards low - the risk we take is high. Who's comforted to know - the reservoir's gone dry?

Water for a Growing Virginia

Schnabel Engineering is providing an array of engineering services for the design and construction of three major new water supply reservoirs within the Commonwealth of Virginia. In combination, these three new dam and reservoir projects will provide more than 70 million gallons per day (mgd) of added water supply yield:

- Ragged Mountain Dam and Reservoir – Ultimate safe yield of approximately 10 mgd to Rivanna Water and Sewer Authority (Albemarle County and the City of Charlottesville)
- Rocky Pen Run Dam and Reservoir – 13 mgd to Stafford County
- Cobbs Creek Dam and Reservoir – 50 mgd to Henrico County, Goochland County, Powhatan County and Cumberland County



- 125-ft high zoned, earthfill embankment
- Abutment tunnel principal spillway/water supply release/ reservoir drawdown
- Rock cut auxiliary spillway
- Uses existing dam as construction cofferdam
- Provides up to 10 mgd of additional water supply (with dam raising and pumped diversions from the South Rivanna River added at a later date)

Ragged Mountain Dam

Client: Rivanna Water & Sewer Authority, Charlottesville, VA

Schnabel Engineering was engaged to design a major dam replacement to Rivanna's nearly 100 year old Ragged Mountain Dam. The New Ragged Mountain Dam eliminates dam safety concerns and provides an ultimate safe yield of about 10 mgd to meet future needs for Albemarle County and the City of Charlottesville.

Rocky Pen Run Dam

Client: Stafford County, VA

Working in tandem with URS, the project's design engineer, Schnabel Engineering is providing all construction engineering services together with value engineering throughout the alternatives analysis, preliminary and final design phases for this new water supply dam. Schnabel has thus far overseen dam excavation and foundation treatment contracts, with dam construction slated to begin this winter.

- 130-ft high zoned, earthfill embankment
- Five-cycle labyrinth spillway with converging chute
- Value engineering efforts have translated to more than $25 million in project savings
  - $5 million - foundation for original RCC dam concept
  - $10 million – change to earth dam with abutment spillway
  - $10 million – change in pool level reduces spillway size
- Provides 13 mgd water supply yield with pumped diversions from the Rappahannock River

Cobbs Creek Dam

Client: Henrico County, VA

This major new reservoir is to provide up to 50 million gallons per day of water supply to four Richmond area counties (Henrico, Powhatan, Goochland, and Cumberland). Schnabel, the dam design engineer, is working with Malcolm Pirnie (the Water Division of Arcadis), who is providing overall project management of a 150 mgd James River intake and pumping station and environmental mitigation services. Dam construction is slated for completion in 2018.

- 150-ft high zoned, earthfill embankment or composite earth fill and RCC dam
- Initial field investigations and alternatives analyses currently underway
- Earth dam option will require nearly 3,000,000 cubic yards of fill
- Provides 50 mgd of water supply yield
- Construction scheduled for completion in 2018