



## Toy Poole, Ph.D.

### SENIOR PRINCIPAL SCIENTIST

Dr. Poole specializes in chemical reactions in cementitious material, including concrete properties, alkali-aggregate reactions, concrete curing, troubleshooting early slump loss, setting time problems and failure analysis of concrete in structures, as well as the statistical analysis of data. He has been an active member of ASTM since 1985 and is currently a member of the ASTM International Board of Directors, where he develops internationally-accepted test methods and specification standards. Prior to joining CTLGroup, Dr. Poole served as a chemist in the U.S. Army Corps of Engineers Research and Development Center in Vicksburg, MI. There, he analyzed damaged concrete structures, researched hydration reactions and concrete workability, studied the damaging effects of salts on concrete in waste disposal and managed the Corps' cement and pozzolan testing facility.

#### Academic Credentials

Ph.D. in Biology  
Indiana University, 1987

M.S. in Biology  
Clemson University, 1978

B.S. in Chemistry  
University of North Carolina,  
1968

#### Licensure/Certification

ASTM International  
Federal Highway Administration  
The Innovative Pavement  
Research Foundation

#### Contact Information

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#### Representative Project Experience

##### **Concrete Dam + Hydraulic Structure Consulting**

- Carters Dam, Carters, GA. 2005. Investigation of deterioration of reregulation dam constructed in 1970.
- Mississippi River L&D's 18, 19, 21, & 22. 2006. General assessment of damage due to freezing and thawing in structures constructed in the 1930's.
- JT Myers Lock and Dam lower Ohio River. 2006. Impact damage to lock walls.
- Overbank Flood-Control Structure 2007. MS River near Natchez, MS. Investigation of joint distress in tainter-gate flood control structure constructed in 1970's.
- Stockton Dam, Stockton, MO. 2008. Investigation of cracking in trunnion block structure of spillway constructed in 1969.
- Cochiti Dam, near Albuquerque, NM. 2009. Investigation of cracking in concrete outlet structure constructed in 1965.
- Yadkin Dam, Badin, NC. 2011. Investigation into expected residual effects of ASR in a 1927 hydropower structure.
- Investigation of problems with concrete repair materials used in restoration of manhole suffering sulfuric acid attack, Austin, TX 2011.
- Safe Harbor Dam, Conestoga, PA. 2012. Investigation into expected residual effects of ASR in a 1930 hydropower structure.
- Saluda Dam, near Cayce, SC. 2013. Investigation of structural deformation in spillway structures constructed in 1931 and 1945.
- Blue Lake Dam, Sitka, AK. 2014. Investigation of surface damage to newly constructed spillway.
- Hydropower dam in sub-Saharan Africa. 2016. Investigation into biogenic sulfuric acid surface damage to scroll-case walls in powerhouse structure constructed in 2012. *Confidential Client and Location Information.*

##### **Test Method + Specification Development**

- Contributed to the development of specifications and test methods involving coal fly ash, slag cement, hydraulic cements, alkali-aggregate reaction, permeability of concrete and statistical analysis of concrete data.

##### **Performance of Cementitious Materials in Concrete**

- Studied the damaging effects of high-concentration salts on concretes used in underground salt formations for nuclear waste isolation.
- Researched early hydration reactions in cement-fly ash mixtures, chemical basis for concrete workability problems and curing portland-cement concrete pavement.

#### **Failure Analysis of Fresh + Hardened Concrete**

- Developed repair materials for bomb damaged concrete pavements.
- Performed forensic analysis of damaged concrete in hydraulic structures and military airfield pavements.

#### **Alkali Aggregate Reaction**

- Developed remedial treatment of ASR-affected airfield pavements with lithium salts at Ft. Campbell, KY.
- Analyzed field and laboratory behavior of ASR-affected concrete.
- Tested materials for hydraulic structures for ASR susceptibility.

#### **Litigation Support**

Fireman's Fund Insurance vs US Army Corps of Engineers. US Federal Claims Court. Expert witness in a dispute over inferior materials used in construction of Montgomery Point Lock and Dam. 2009.

Mesa Verde Materials vs Southwest Concrete Paving Co. Expert witness in a claim of inferior materials. Settled prior to trial. 2011.

Spaceport America vs Montoya Construction. Expert witness in mediation concerning failed concrete runway. 2013.

US Air Force vs American Construction. Expert witness in dispute over problems with new construction of concrete taxiway pavement, Offutt AFB. Settled prior to trial. 2014-2015.

City of Los Angeles vs RL Brossomer. Expert witness in dispute over concrete runway construction defects. 2018.

#### **Publications and Reports**

Wong, G. Sam and Toy S. Poole. 1988. "Sulfate Resistance of Mortars Made Using Portland Cement and Blends of Portland Cement and Pozzolan or Slag." Technical Report SL-88-34, USAE Waterways Experiment Station, Vicksburg, MS.

Wakeley, Lillian D. and Toy S. Poole. 1987. "Studies of the Geochemical Stability of a Salt-Saturated Expansive Grout." MP SL-87-10. USAE Waterways Experiment Station, Vicksburg, MS.

Poole, T. S., M. C. Sykes, and S. D. Griffin. 1990. "Preliminary Investigation of Cementitious Materials for Olmstead Lock and Dam," Miscellaneous Paper SL-90-3, USAE Waterways Experiment Station, Vicksburg, MS.

Poole, T. S., J. B. Cook. 1991. "Effect of Changing Fly Ash Content, Temperature, and Calcium Chloride Levels on Strength Development of Mortars and Time of Setting of Pastes," Miscellaneous Paper SL-91-5, USAE Waterways Experiment Station, Vicksburg, MS.

Wakeley, L. D., Poole, T. S., Erzen, J. J., and Neeley, B. D. 1993. "Salt Saturated Mass Concrete Under Chemical Attack." in High Performance Concrete in Severe Environments, ACI SP-140, P. Zia ed., pp.239-267.

Poole, T. S. 1993. "Stability of Calcium Chloroaluminate and Calcium Sulfoaluminate Phases in Hydraulic-Cement Mixtures. Miscellaneous Paper SL-93-9, USAE Waterways Experiment Station.

Poole, T. S. 1993. "Problems with Fineness Testing of Coal Fly Ash for Use in Concrete."

Miscellaneous Paper SL-93-9, USAE Waterways Experiment Station, Vicksburg, MS.

Poole, T. S. and Wakeley, L. D. 1993. "Length Change and Strength Development of Candidate Cement-Based Sealing Mixtures for the WIPP. Technical Report SL-93-4, USAE Waterways Experiment Station, Vicksburg, MS.

Poole, T. S. and Wakeley, L. D., Young, C. L. 1994. "Individual and Combined Effects of Chloride, Sulfate, and Magnesium Ions on Hydrated Portland-Cement Paste." SAND93-7040, Sandia National Laboratories, Albuquerque, NM.

Wakeley, L. D., Poole, T. S., and Burkes, 1994. "Durability of Concrete Materials in High-Magnesium Brine." SAND93-7073. Sandia National Laboratories, Albuquerque, NM.

Poole, T. S. 1995. "Use of Large Quantities of Fly Ash in Concrete," Technical Report SL 95-9, USAE Waterways Experiment Station, Vicksburg, MS.

Poole, T. S. and Harrington, P. J. 1996. "An Evaluation of the Maturity Method (ASTM C 1074) for Use in Mass Concrete." Technical Report SL-96-16, USAE Waterways Experiment Station, Vicksburg, MS.

Neeley, B. D. and Poole, T. S. 1996. "Methods of Preparing Horizontal Construction Joints in Mass Concrete," Technical Report SL-96-2, USAE Waterways Experiment Station, Vicksburg, MS.

Malone, P.G., T.S. Poole, L.D. Wakeley, J.P. Burkes. 1997. Salt related expansion reactions in Portland-cement-based waste forms. J. of Hazardous Materials, v 52: 237-246.

Green, B. H., Neeley, B. D., and Poole, Toy S. 1998. "Evaluation of Criteria for Uniformity of Roller-Compacted Concrete." Technical Report REMR-CS-55, Feb 1998, USAE Waterways Experiment Station, Vicksburg, MS.

Poole, Toy S. 1998. Changes in ASTM Type II Portland Cement from 1940 to 1994. "Cement, Concrete, and Aggregates Vol. 20(1), pp 157 - 162."

Wong, G.S., A.M. Alexander, R. Haskins, T.S. Poole, P.G. Malone, L. Wakeley. 2001. "Portland-Cement Concrete Rheology and Workability." FHWA Publication No. FHWA-RD-00-025.

Poole, T.S. 2001. Methods for Measuring Application Rate of Liquid Membrane-Forming Curing Compounds on Concrete Pavements. Proceedings of the 7th International Conference on Concrete Pavements. Sept 2001, pp 351 – 360.

Poole, Toy S. 2002. Laboratory Investigation of Cores Taken from Penstock Supports at Summersville Dam for Evidence and Prognosis of AAR. CMB Report 02-020. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.

Poole, Toy S. 2004. Guide for Curing Portland Cement Concrete Pavements. FHWA-RD-02-099. Federal Highway Administration. McLean VA.

Poole, Toy S. 2004. Effect of Cement Alkalis on Development of Alkali-Carbonate Reaction. CBM Report 04-014, US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.

Poole, Toy S. and G. Sam Wong. 2004. Investigation of Concrete Patching Problems at Holloman AFB. CMB Report 04-013, US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.

Poole, Toy S. and Charles A. Weiss. 2005. Investigation of Damaged Concrete from Hangar 18 Parking Ramp, Andrews AFB. CMB 05-008, US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.

- Poole, Toy S., Charles A. Weiss, Christopher Moore, and G. Sam Wong. 2005. Analysis of Runway Concrete from Laughlin AFB, TX for Cause of Aggregate Popouts. CMB 06-002, US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Poole, Toy S., Charles A. Weiss, and Christopher Moore. 2005. Investigation of Damage to Concrete in Reregulation Dam, Carters Lake, GA. CMB 05-017. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Poole, Toy S. 2006. Techniques, Procedures, and Practices of Sampling of Concrete and Concrete Making Materials. in Significance of Tests and Properties of Concrete and Concrete-Making Materials, ASTM STP 169D. ASTM, West Conshohocken, PA.
- Rollings, Raymond S., M.P. Rollings, Toy Poole, G. Sam Wong, and Gene Gutierrez. 2006. Investigation of Heaving at Holloman Air Force Base, New Mexico. J. of Performance of Constructed Facilities, Feb 2006, pp 54-63.
- Wong, G. Sam and Toy S. Poole. 2006. Results of Concrete Investigation for the Embankment and Outlet Works, Prado Dam, USACE Los Angeles District. CMB 06-003. USACE ERDC GSL, Vicksburg, MS
- Poole, Toy S. 2006. "Guide for Curing of Portland Cement Concrete Pavements, Volume II." FHWA Publication No. FHWA-HRT-05-038, Federal Highway Administration, Turner-Fairbank Highway Research Center, McLean, VA.
- Saeed, Athar, M. Hammons, P. Feldman, and T. Poole. 2006. "Evaluation, Design, and Construction Techniques for Air Force Concrete Pavement Used as Recycled Base Material for Base." Innovative Pavement Research Foundation Project 03-05, Report No. IPRF-01-G-002-03-05. (Wrote a chapter on environmental issues and contributed to technical discussions on ASR issues).
- Poole, Toy S. 2006. "Report of Examination of Concrete Cores from Andersen AFB, Guam." CMB Report 06-013, August 2006. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Freeman, R.B., D.A. Goss, P.S. McCaffrey, J.G. Tom, T.S. Poole, T.L. Landris, and P.A. Taylor. 2006. "Unbonded Aggregate Surface Roads" EERDC/GSL TR 06-26.
- Poole, Toy S. 2007. "Revision of Test Methods and Specifications for Controlling Heat of Hydration in Hydraulic-Cement," PCA R&D Serial No. 3007, Portland Cement Association, Skokie, IL.
- Poole, T.S. and E.F. O'Neil. 2007. "Evaluation of Stone-Monument Repair Materials for Potential Use in Interim Repair of Frost-Damaged Concrete Navigation Structures." ERDC/GSL SR-07-04.
- Rowell, S.P., Poole, T.S., Tom, J.G., Weiss, C.A. 2007. "Results of Terracotta and Terracotta Mortar Investigation", ERDC/GSL TR-07-7.
- Poole, T.S. and C.A. Weiss. 2007. "Report of Analysis of Cracked Concrete from Crash Fire Station, MacDill AFB, FL." CMB Report 07-002. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Toy S. Poole, T.S., Richard W. Haskins, and Charles A. Weiss, Jr. 2007. "Report of Analysis of Concrete Exposed to Simulated Conditions of the F 35 Integrated Power Package." CMB Report 07-010. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Poole, T.S. and C.A. Weiss, and G.S. Wong. 2007. "Analysis of Cause Damage to Airfield Concrete at Offutt Air Force Base, CMB Report 07-013. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.

- Rollings, Raymond, Toy Poole, Craig Rutland, Marian Rollings. 2008. "Early-Age Spalling on USAF Airfield Pavements," Proceedings, 9th International Conference on Concrete Pavements, San Francisco, CA.
- Poole, Toy S. and C. A. Weiss. 2008. Results of Investigation of Damaged Concrete Constuction Joints at the Old River Overbank Structure. CMB 08-001. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Poole, Toy S. and D.C. Day. 2008. Results of Investigation of ASR in Cores from Airfield Pavement at Ellworth AFB, SD. CMB 08-003. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Poole, Toy S. and M.C. Sykes. 2008. Analysis ASR Potential of Recycled Concrete for Base at Tyndall AFB. CMB 08-006. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Poole, Toy S. 2008. Results of Investigation of ASR in Cores from Airfield Pavement at Pope AFB, NC. For USAF. CMB 08-010. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Poole, Toy S. 2008 Results of Investigations for Evidence of ASR in Sampls of Airfield Pavement from Fairchild AFB, WA. CMB 08-011. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Poole, Toy S., C.A. Weiss, C. Moore, M.C. Sykes, and B. Green. 2008. Analysis of Middle East Construction Materials. CMB 08-013. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Poole, Toy S. 2009. "Predicting 7-day Heat of Hydration of Hydraulic Cement from Standard Test Properties." J. ASTM Vol 6, No 6, 2009, paper ID JA102084.
- Poole, Toy S. and R. Rollings. 2009. , "Investigation of Sliver-Spall Damage at Offutt Air Force Base, Nebraska. ERDC/GSL TR-09-06. USACE R&D Center, Vicksburg, MS.
- ASTM C 1702-09, "Standard Test Method for Measurement of Heat of Hydration of Hydraulic Cementitious Materials Using Isothermal Conduction Calorimetry."
- Poole, Toy S. 2009. "Results of Investigation of Concrete Cores from Cochiti Dam (NM) Intake Tower," CMB Report 09-010. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Poole, Toy S. 2009. "Results of Investigation for Evidence of Alkali-Silica Reaction (ASR) In Samples of Concrete from Tonopah Test Range, Nevada," CMB Report 09-009. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Poole, Toy S. 2009. "Results of Investigation of Alkali-Silica Reaction (ASR) in Cores from Airfield Pavement at Buckley AFB, CO," CMB Report 09-001. US Army Corps of Engineers R&D Center (GM-C), Vicksburg, MS.
- Poole, T.S. 2012. Analysis of pavement strength problems, Spaceport America
- Poole, T.S. and J.C. Araiza. 2013. Investigation of joint faulting in airfield pavement at Muscatine, Iowa.
- Poole, T.S. 2014. Review of cause of cracking near joints in KSDOT highway pavements.
- Martin, T. and Poole T. 2014. Analysis of concrete paving problems – NW Arkansas Regional Airport.
- Martin, T. and Poole T. 2014. Analysis of concrete paving problems at Offutt Air Force Base,

Omaha, NE.

Poole, T.S. 2016. Analysis of cracking problems in concrete airfield pavement during construction. US Army, Ft. Bliss, TX.

### **Prior Experience**

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CTLGroup, Austin, Texas  
Senior Principal Scientist, 2010 - Present

U. S. Army Engineer Research and Development Center (ERDC), Vicksburg, Mississippi, 1980  
– retired March 2010

Research Chemist, Concrete and Materials Branch, Engineering Systems and Materials Division, Geotechnical and Structures Laboratory (GSL)

Clemson University, Clemson, South Carolina  
Analytical Chemist, 1977

US Army  
Electronics Technician, 1969 - 1971

### **Professional Affiliations**

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American Society for Testing and Materials (ASTM) Member  
ASTM committees C 01 (cement) and C 09 (concrete) since 1985  
Honorary committee member of C 01 and C 09  
Recipient of the C 01 Bryant Mather Award (2003)  
Recipient of the C 09 Frank E. Richart Award (2004)  
Recipient of the ASTM Society Award of Merit – Fellow of ASTM (2004)  
Chaired several subcommittees in both C 1 and C 9  
Held committee officer positions  
Current chair of subcommittees C 9.67 (Concrete Resistance to Environment) and C 9.95 (Analysis of Data)  
Member the ASTM International Board of Directors 2009 - 2011

### **Concrete Related Technical Advisory Committees**

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FHWA Project RDT-QX5(1) on use of lithium in new and old concrete construction suffering damage from ASR.

IPRF (FAA) Project 03-09 on potential for acceleration of ASR in the presence of pavement deicing chemicals

IPRF (FAA) Project 05-07 performance of concrete in the presence of airfield pavement deicers and identification of induced distress mechanisms.

IPRF (FAA) Project 03-10 on effect of lithium salts on inhibiting ASR in old pavements with ASR