Haejin Kim, Ph.D., P.E.

Senior Engineer

Dr. Haejin Kim is a distinguished professional engineer and concrete researcher known for his significant contributions to the field of concrete technology. Dr. Kim's career has been marked by pioneering projects, from innovative aggregate systems to sustainable concrete methodologies, often in collaboration with organizations like the Federal Highway Administration (FHWA) and State DOTs. Dr. Kim served as the Director of the National Ready Mixed Concrete Association's Research Laboratory (NRMCA), where he engaged in practical research projects funded by the Ready Mixed Concrete Research & Education Foundation. His research contributions are well-documented in various publications.

Beyond academia, Dr. Kim has hands-on experience supervising significant infrastructure projects, such as the commuter railway project between Tutuban and Malolos in the Philippines. Holding professional engineering licenses in Virginia, Maryland, and Michigan, Dr. Kim remains committed to advancing concrete technology, embodying a dedication to ongoing learning and excellence in his field.

Concrete Technology

New Technology Based Approach to Advance Higher Volume Fly Ash Concrete with Acceptable Performance

- Served as a mentor to a Ph.D. candidate. The research probed into the intricacies of high volume fly ash concrete, with up to 50% mass replacement. Central to this study was the maturity method, analyzing early-age strength development via in-situ concrete temperature changes. A significant component involved discerning the activation energy of fly ash mortar/concrete mixtures, later utilized as a crucial maturity model parameter to predict in-situ concrete strength.

Crushed Returned Concrete as Aggregates for New Concrete

- Led a study on the potential of utilizing crushed returned concrete from ready-mix plants as aggregates for new concrete. This research differentiated clean crushed return concrete aggregate (CCA) from typical recycled concrete aggregate (RCA). Lab evaluations were conducted on CCA at three strength benchmarks (1000, 3000, 5000 psi), assessing its influence on concrete strength and other durability factors, notably freeze-thaw resistance.

Pervious Concrete Mixture Proportioning Methodology

- Led project focused on refining a methodology for pervious concrete mixture design. This initiative was inspired by past porous concrete studies at NRMCA RL from the 1970s. Extensive lab tests were undertaken to validate the 'paste compression index', relating it to compaction and the water/cement (w/c) ratio. Additionally, the project sought to correlate the falling head water permeability with the strength of the pervious concrete.

Academic Credentials

Ph.D. in Civil Engineering University of Maryland at College Park, 2009

M.S. in Civil Engineering University of Maryland at College Park, 2003

B.S. in Civil Engineering Kyungnam University, South Korea, 1995

Licensure & Certifications

Professional Engineer VA, MD, MI

Professional Affiliations

American Concrete Institute

American Society of Testing and Materials

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Concrete Permeability against Chloride Ingress

- Focused on measuring the chloride diffusion coefficient (ASTM C1556) and its correlation with various durability tests.

Concrete Permeability against Sulfate Ingress

- Evaluated sulfate resistance in concrete and mortar specimens, linking findings with diverse durability tests.

Concrete Durability against Freeze-Thaw Resistance

- Assessed concrete's freeze-thaw resistance (ASTM C666, C672) and its correlation with multiple durability tests.

Improvement of HVFA Mixtures Using Nano-Aluminosilicates

- Contributed to a research initiative that concentrated on leveraging nano-aluminosilicates. The objective was to bolster the early age attributes of high volume fly ash (HVFA) mixtures.

Investigation of Air Void System in Concrete Mixtures

- Instrumental in a research endeavor that delved into the air void system of 64 concrete mixtures. Methodology employed both conventional testing measures for fresh and hardened concrete and was complemented with the innovative SAM (Super Air Meter) test approach.

Effect of Continuous (well-graded) Combined Aggregate Grading on Concrete Performance

- Led a project that centered on analyzing packing density models for combined aggregate systems. Phase A involved laboratory evaluations to confirm void contents from these models. Subsequently, Phase B examined the influence of these packing densities on the performance of both fresh and hardened concrete.

Adsorption Capacity of Fly Ash: Fluorescence vs. Foam Index

- Undertook a study that aimed to explore the feasibility of utilizing the fluorescence method to accurately measure the adsorption capacity of fly ash. Furthermore, this research sought to contrast the results derived from the fluorescence technique with those obtained from the foam index test.

Effect of Unconventional Aggregate Characteristics on Concrete

- Part of a collaborative initiative between Turner-Fairbank Highway Research Center and the National Institute of Standards and Technology (NIST). The project's primary objective was to evaluate and quantify the influence of often-neglected aggregate properties on the mechanical behavior of concrete.

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Comparison of Field and Laboratory Test Results for Alkali-Silica Reaction

- Involved in research that compared results from the Modified Concrete Prism Test, Concrete Cylinder Test, Concrete Prism Test, and exposed blocks. The central aim was to ascertain the reliability of these tests in forecasting the real-world performance of concrete mixtures, especially concerning Alkali-Silica Reaction.

Evaluation of Deicing Salts on Concrete Transport Properties

- Led a research endeavor examining the combined impacts of diffusion and absorption on concrete samples when exposed to deicing salts. The comprehensive study evaluated mixtures including plain concrete, 30% fly ash F, and 50% slag cement, with water-to-cement ratios of either 0.42 or 0.50. These were then exposed to salts like NaCl, $CaCl_2$, and $MgCl_2$ under continuous and cyclic wet-dry conditions for a year.

Transportation Technology

Feasibility of Using Smaller Specimen Sizes in Concrete Mixtures

- Participated in an FHWA study examining smaller specimen sizes for testing concrete flexural strength, crucial for pavement design. Traditionally, testing used large, 65-pound specimens, posing injury risks and causing many State transportation departments to bypass such tests. To address this, the FHWA study was split into two phases. The initial phase, ending in 2015, explored the viability of compact concrete beams as test specimens. The subsequent phase in 2018 gauged the testing precision of both traditional and smaller beams. The aim was to enhance safety without compromising testing accuracy.

Shift from Prescriptive to Performance Approach in Concrete Mixtures Design and Quality Assurance

- Contributed to a project in collaboration with the Federal Highway Administration, State DOTs, academia, and industry experts. The mission was to promote the creation of durable, long-lasting, and cost-effective concrete infrastructures. Central to this was the paradigm shift from traditional prescriptive methods of concrete mixture design and quality assurance to a more performance-driven approach.

Greatly Increased Use of Fly Ash in Hydraulic Cement Concrete (HCC) for Pavement Layers and Transportation Structures

- Engaged in a project that aimed to bolster the extensive use of varied fly ash types in Hydraulic Cement Concrete, particularly for paving and transportation structures. Central to this initiative was the formulation of activation energy parameters for low, intermediate, and high lime fly ash with both low and high alkali cements, adhering to the ASTM C1074 standards.

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Phase 1 of 38 km-long Railway Line Connecting Malolos in the Province of Bulacan to Tutuban in Manila

- Served as the Consultant and Resident Viaduct Engineer for the north-south commuter railway project between Tutuban and Malolos in the Philippines while working at Katahira Engineers International as part of the NSTren Consortium (including OCSG, KEI, NK, PCI & TEC). This role involved supervising seven engineers and two inspectors, overseeing 19 miles of viaducts and segmental bridges, and managing the inspection and testing of the precast box girder segment production. I also supported design reviews, evaluated method statements, actively participated in construction meetings, issued non-conformance reports, and successfully resolved a concrete cracking issue in the precast box girder segment production.

Publications

- "**Well Graded Aggregates and Concrete Performance**," Concrete International, March 2008.
- "**Effect of Continuous (Well-Graded) Combined Aggregate Grading on Concrete Performance Phase A: Aggregate Voids Content (Packing Density)**," NRMCA, Silver Spring, MD, May 2007.
- "**Effect of Continuous (Well-Graded) Combined Aggregate Grading on Concrete Performance Phase B: Concrete Performance**," NRMCA, Silver Spring, MD, May 2007.
- "**Sustainable Concrete through the Reuse of Crushed Returned Concrete**," Journal of the Transportation Research Board, No. 2113, Concrete Materials 2009, pp. 114-121.
- "**Crushed Returned Concrete as Aggregates for New Concrete**," RMC Research Foundation, Project 05-13, July 2007, 35 pp.
- "**Pervious Concrete: Mixture Proportioning Guideline & Software - CD,**" NRMCA Publication, #2PE001, Feb. 2009 (featured as a best-seller in InFocus Magazine).
- "**Pervious Concrete: Guideline to Mixture Proportioning and Research Report**," NRMCA Publication, #2PE002, Feb. 2009.
- "**Optimizing Concrete Mixtures for Performance and Sustainability**," NRMCA Concrete Technology Forum, May 2012.
- "**Selection of Rapid Index Tests and Criteria for Concrete Resistant to Chloride Penetration**," Transportation Research Board, 2014.
- "**Criteria for Freeze-Thaw Resistant Concrete Mixtures**," Advances in Civil Engineering Materials, 2016.
- "**Tests and Criteria for Concrete Resistant to Chloride Ion Penetration**," ACI Materials Journal, 2016.
- "**Greatly Increased use of Fly Ash in Hydraulic Cement Concrete for Pavement Layers and Transportation Structures – Volume I,**" Final Report to Research Consortium led by Purdue University and funded by FHWA, March 2012.

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- "**Increased Use of Fly Ash in Hydraulic Cement Concrete (HCC) for Pavement Layers and Transportation Structures**," Purdue University, 2012.
- "**Analysis of The Impact of Deicing Salts on Transport Properties of Concrete Preliminary Results**," presented at the 11th International Conference on Concrete Pavement, San Antonio, Texas, Aug-Sep 2016.
- "**Impact of Deicing Salts on Transport Properties of Concrete**," presented at the Transportation Research Board, 2017.
- "**Influence of Aggregate Characteristics on Concrete Performance**," NIST Technical Note 1963, U.S. Department of Commerce, May 2017.
- "**Influence of Aggregate Properties on Concrete Mechanical Performance**," presented at the Transportation Research Board, 2017.
- "**Bigger Is Not Always Better,**" Public Roads 82 (2), 2018.
- "**Divergence between Performance in the Field and Laboratory Test Results for Alkali-Silica Reaction**," Transportation Research Record, 2020.
- "**Influence of Loading Pressure on Ionic Concentration of Pore Solution Expressed from Concrete Samples**," Journal of Testing and Evaluation, 2020.
- "**Quantification of Calcium Oxychloride by Differential Scanning Calorimetry: Validation and Optimization of the Testing Procedure**," Advances in Civil Engineering Materials, 2021.