Koray Tureyen

PhD, PE

Senior Managing Consultant, Civil & Structural

Dr. Koray Tureyen solves complex engineering problems at various scales, employing a blend of evidence collection, analysis, and research, and insights gained from experience. He started his career as an instructor at Purdue University, but his passion for investigation led him to forensic consulting at Wiss, Janney, Elstner Associates Inc. and Engineering Systems, Inc.

Dr Tureyen's tenure as a forensic consultant provided him with experience in a range of engineering and architectural disciplines and sectors, and he developed a deep understanding of physical, mechanical, and chemical behavior and distress mechanisms of historical and current engineering materials. He has wide ranging failure investigation experience involving underground structures, foundations, slabs on ground, parking structures, transportation structures, auditoriums, hospitals, high-rise structures of concrete, steel, masonry, and wood construction, traditional and renewable energy structures, various building facade systems, roofing and waterproofing systems, and coatings. These investigations often combine advanced structural analyses, petrographic, chemical and metallurgical analyses, and non-destructive inspection and testing methods to characterize failures.

Dr. Tureyen has experience in assessing damage to the built environment after disasters such as earthquakes, wind, fire, explosions, and water exposure. He has conducted assessments of damage on a wide range of structures constructed of reinforced, pre/post-tensioned concrete, steel, masonry, and wood, as well as architectural components and systems such as facades, roofing and waterproofing. He has been involved in the design of repairs, rehabilitation, and strengthening of structures he assesses.

Dr. Tureyen's recent work has focused on solar and wind energy generation structures, communication towers, reinforced and post-tensioned concrete structures, exterior envelopes of commercial and university buildings, and repair and renovation design of concrete, steel and wood structures.

Education

PhD, Civil Engineering. Purdue University. 2001

BSc, Civil Engineering. Middle East Technical University. 1997

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Areas of Specialization

- Failure Investigation
- Pre/Post-Tensioned Concrete Structures
- Explosion & Fire Damage
- Earthquake & Wind Damage
- Advanced Structural Analyses
- Earthquake & Wind Engineering
- Renewable Energy Structures
- Telecommunication Structures
- Non-destructive Inspection
- Instrumentation & Monitoring
- Steel/Masonry/Wood Construction
- Building Façade Systems
- Roofing & Waterproofing
- Transportation Structures
- Soil Structure Interaction
- Geotechnical Engineering
- Fiber-Reinforced Polymer Materials

Licenses & Certifications

- State of Florida P.E. License 101913
- State of Michigan P.E. License 6201052221
- State of Missouri P.E. License 2025018554
- State of Ohio P.E. License 92308
- Fracture Critical Insp/Steel Bridges NHI 130078 Certification

Languages

- English, Turkish

Positions Held

Engineering Systems Inc., Aurora, Illinois

- Senior Managing Consultant, 2024 – Present

Wiss, Janney, Elstner Associates, Inc., Northbrook, Illinois

- Senior Associate, 2007–2024

Wiss, Janney, Elstner Associates, Inc., Detroit, Michigan

- Associate I–III, 2002–2007

Purdue University, West Lafayette, Indiana

- Adjunct Professor, 2002

Professional Affiliations/Honors

American Concrete Institute

- Member, Committee 349, 00 Concrete Nuclear Structures, Current
- Member, Committee 349, 0B Nuclear Structures - Design, Current
- Member, Committee 408, Bond and Anchorage, Past
- Member, Committee 445, Shear and Torsion, Past

BSSC 2023 Provision Update Committee

- Member, Issue Team #1: Soil-Structure Interaction, Past
- Member, Issue Team #6: Two-Stage Analysis Provisions, Past

American Society of Civil Engineers

- Member, Current

Precast-Prestressed Concrete Institute

- Member, Past

American Concrete Institute

- Peer Reviewer, Structural Journal, Past

American Society of Civil Engineers

- Peer Reviewer, Journal of Structural Engineering, Past

Project Experience

Failure Investigation and Condition Assessment

- Dr. Tureyen conducts failure investigations of a wide range of construction materials and systems such as reinforced/prestressed/ post-tensioned concrete, steel, wood and fiber reinforced polymers, and various architectural systems including facades, roofing systems, and waterproofing systems.
- Investigations ranged from root cause assessment/analysis (RCA) of structural failures in steel and wood structures during erection to RCA of water intrusion in architectural systems such as windows, curtainwalls, stucco, EIFS, and masonry façade systems, as well as coating systems.
- Investigations for failure characterization were often multi-disciplinary in nature and involved advanced structural analyses, chemical, petrographic and metallurgical examinations, non- destructive testing, and field instrumentation and testing.
- Examples of investigated structures include precast pre-stressed and post-tensioned parking garages, structural steel bridges and canopies, metal plate connected wood trusses, open-webbed steel trusses, concrete and steel bridges, reinforced concrete shallow foundations, reinforced concrete pavements and slabs on ground, reinforced concrete grain silos, among others.
- Examples of investigated architectural and waterproofing systems include gypsum concrete (Gypcrete™) flooring underlayment, mass masonry, masonry veneer, precast concrete panel, aluminum framed glass curtainwalls, windows, historical and modern stucco finish systems including Exterior Insulation and Finish System (EIFS); built-up, modified bitumen, EPDM and PVC roof systems, liquid and sheet applied above and below ground waterproofing systems including polyurethane, bitumen and modified bitumen, polymethyl methacrylate (PMMA), and bentonite.
- Condition assessment projects included determination of distress involving causes such as corrosion, high and low temperature exposure, material incompatibility and chemical attack such as due to fire, environmental, chemical, or use and maintenance related exposure of concrete and gypcrete, roofing and waterproofing systems, masonry, precast concrete, aluminum framed glass curtainwall systems, sealants, architectural coatings, lumber, timber and plywood, among others and involved conceptual and/or actual

design of repairs to the assessed systems and structures to address the identified system deficiencies. Oftentimes, these repairs also had economic and technical feasibility analyses comparing alternative methods of addressing the same problem.

Solar Power Generating Stations

- Dr. Tureyen conducts structural design peer reviews of new industrial scale solar power generating stations, failure investigations of solar power generation stations, and permit and construction period consultation for municipalities.
- Structural design peer review projects involved single-axis solar tracking systems from manufacturers including NEXTracker, Array, GameChange, PVH Hardware, as well as pier design for these systems. These projects typically involved modeling and advanced structural analyses of the trackers using static and dynamic loading generated by others from wind tunnel studies to verify all components and connections of the solar tracker systems and their pile foundations were adequately designed.
- Failure investigations at solar power generating stations typically involved failures of single- and double-axis solar tracker systems after various wind events such as thunderstorms and tornadoes, and in rare instances operational failures due to design or construction errors. Since failures typically occurred during windstorms with speeds significantly lower than the site's design wind speed, dynamic amplification effects were investigated using vibration testing on-site combined with advanced structural analyses to pinpoint the root cause.
- One project involved providing corrosion engineering services involving peer review findings of soil corrosivity studies by third parties, and design assistance and quality assurance services for corrosion protection of pile supports installed in medium- to high-corrosion potential soils.
- Dr. Tureyen conducted failure investigations of single-axis and double-axis solar tracking systems involving component failures due to design errors by the tracker system manufacturer or foundation designer.

Wind Power Generating Stations

- Dr Tureyen conducted design reviews of land-based wind turbine foundations, feasibility studies of existing wind turbine foundations for re-powering reuse, and developed demolition plans for partially collapsed wind turbine towers.
- Structural design peer review projects involved analytical studies to quantify demands on foundations, and assisting the designer of record in developing appropriate detailing/placement of reinforcing embedded in the unusually large turbine foundations as well as estimating their ultimate and fatigue strength.
- Wind turbine re-powering projects involved conducting advanced structural analyses to determine whether the proposed new turbine can be safely supported by the existing foundation for the life of the new turbine. History of cyclic loading, typically provided by the turbine manufacturer and/or the operator in the form of Rain flow Counting data, for the existing turbine and the estimated loading for the new turbine was utilized in sophisticated structural analyses to estimate demands and compare them with

applicable standards, typically DNV standards, to assess the existing turbine foundation's adequacy of its intended future use.

- Safe demolition of partially collapsed wind turbine towers poses unique challenges, such as design of direction of full demolition, consideration of wind loads on the partially collapsed structure, and stability of partially collapsed structure during preparation for demolition and during demolition activities.

Communication Towers

- Dr. Tureyen conducted failure investigation of masts on communication towers and design review and consulting for improvement of tower details for owners, design services providers, manufacturers and erectors, the Division of State Architect of California, the California Highway Patrol, and the Department of Forestry and Fire Protection.
- Failure investigation projects typically involve metallurgical studies and advanced vortex shedding analyses of tower mast and lightning rods, which are susceptible to fatigue failure.
- Design review projects involved review of tower designs by others and development of modifications to improve fatigue strength tower masts and lightning rods.

Earthquake Engineering

- Dr. Tureyen conducted assessments of existing structures using ASCE 7/ASCE 41 evaluation criteria, modal analyses, linear and non-linear time history analyses, push-over analyses, capacity spectrum analyses using ADRS spectra, and design of seismic retrofits for reinforced concrete, precast-prestressed concrete, and hybrid structures.
- Multiple desktop studies involved assessments for the US Department of State of foreign building assets for seismic robustness. Clients for these projects were the state department, the Nuclear Regulatory Commission, and private building owners.
- In one case, modifications to an erroneous seismic retrofit design by another designer for a six-story reinforced concrete hospital building were designed, which involved steel plate shear wall system installed to address "deficiencies" in the reinforced concrete frame system of the 4-story hospital building from the 1970s in a low seismic area.
- Another case involved studying the seismic robustness of a highly irregular reinforced concrete building used as a fire station on a nuclear waste storage and conversion facility and estimation of what level of ground shaking defined in terms of a return period the building may be able to resist was characterized, Identified vulnerabilities were used by the NRC to make decisions on how to reinforce the structure.
- In addition to analytical experience with earthquake engineering, Dr. Tureyen participated in two post-earthquake reconnaissance teams after the 1999 Düzce and Kocaeli earthquakes, and the 2023 Kahramanmaraş and Elbistan earthquake sequence in Türkiye. The teams collected data on regional reinforced concrete building stock for the purpose of learning from damage observed, and disseminated the collected information and lessons learned to the general engineering and construction community to improve the design and construction of new structures.

Presentations

"2023 Kahramanmaraş, Türkiye Earthquake Sequence," **A.K. Tureyen** and A. Irfanoglu, ISEA Spring Conference, Indianapolis, Indiana, March 7, 2024.

"Building and Infrastructure Performance During the Kahramanmaraş Earthquake Sequence," **A.K. Tureyen** and B. Chancellor, IABSE Webinar, Virtual, December 12, 2023.

"It's Simple! It Is Only Concrete Core Compressive Strength Testing," **A.K. Tureyen** and T. Nelson, WJE Webinar Series, Virtual, December 17, 2020.

"Case Study: The Mysterious Case of Staining of a Breathable Exterior Coating," **A.K. Tureyen**, WJE Internal Conference, Northbrook, Illinois, 2015.

"UIUC Natural History Building Elevated Floor Slabs Assessment, Load Testing and Strengthening," **A.K. Tureyen**, WJE Internal Conference, Northbrook, Illinois, 2015.

"Slab Strengthening at an Early 20th Century Historic Building: A Forensic Case Study," **A.K. Tureyen**, CE 691S Structural Engineering Seminars, West Lafayette, Indiana, April 5, 2016.

"Slab-On-Grade: Introduction to Design Considerations," **A.K. Tureyen** and T. Nelson, WJE Internal Webinar, Virtual, 2012.

"Understanding Then Fixing of a Bungled Seismic Retrofit of a 1960s Hospital Building," **A.K. Tureyen** and H. Hill, WJE Internal Conference, Northbrook, IL, 2011.

"Permutations of the Combined Tension and Shear (N-V) Interaction for Headed Studs," **A.K. Tureyen**, N.S. Anderson, and D.F. Meinheit, 2nd International Symposium on Connections Between Steel and Concrete: University of Stuttgart, Stuttgart, Germany, September 4–7, 2007.

"Design Criteria for Headed Studs-Tension and Combined Tension and Shear: Phase 2," **A.K. Tureyen**, N.S. Anderson, and D.F. Meinheit, PCI Annual Convention/Exhibition and National Bridge Conference, Grapevine, TX, October 22–25, 2006.

"Proposal for Unification of Slender Beam Shear Strength Equations in ACI 318-08," **A.K. Tureyen** and R.J. Frosch, ACI-ASCE 445 Fall Meeting, Kansas City, KS, 2005.

Publications

Failures – Roof Drainage: Consider the Details," K.M. Itle and **A.K. Tureyen**, Construction Specifier, Online Article, December 15, 2022.

"Thaumasite Sulfate Attack: Case Studies and Implications," X. Hou, L.J. Powers, J.S. Lawler, and **A.K. Tureyen**, Proceedings of the ICMA Conference, Vol. 37, pp. 23, 2015.

"Shear in Discontinuity Regions: Changes for the ACI 318 Building Code," G.J. Klein, N. Rezaei, D. Garber, and **A.K. Tureyen**, Concrete International (ACI), Vol. 41, No. 5, pp. 36–41, September–October 2012.

"Report on Bond of Steel Reinforcing Bars Under Cyclic Loads," **A.K. Tureyen** et. al., American Concrete Institute, ACI PRC-408.2-12, 2012.

"Seismic Evaluation of Concrete Wall Buildings," B. Kehoe and **A.K. Tureyen**, Proceedings of the 15th World Conference on Earthquake Engineering, 2012.

"Tension Tests of Headed Stud Anchorages in Narrow/Thin Edge Members," N.S. Anderson, **A.K. Tureyen**, and D.F. Meinheit, Befestigungstechnik, Bewehrungstechnik and. 2, Rolf Eligehausen zum 70. Geburtstag / Werner Fuchs; Jan Hoffmann (Hrsg.), 2012

"Bond Strength of Non-metallic Reinforcing Bars," C.P. Mosley, **A.K. Tureyen**, and R.J. Frosch, ACI Structural Journal, Vol. 105, No. 5, pp. 634–642, September–October 2008.

"Permutations of The Combined Tension and Shear (N-V) Interaction for Headed Studs," **A.K. Tureyen**, N.S. Anderson, and D. Meinheit, 2nd International Symposium on Connections Between Steel and Concrete, Stuttgart, Germany, September 4–7, 2007.

"Design Criteria for Headed Studs-Tension and Combined Tension and Shear: Phase 2," N.S. Anderson, **A.K. Tureyen**, and D.M. Meinheit, Wiss, Janney, Elstner Associates Inc., PCI Report: Second Draft, doi:10.15554/pci.rr.conn-005, 2007.

"Strength of Reinforced Concrete T-beams in Shear," **A.K. Tureyen**, T.S. Wolf, and R.J. Frosch, ACI Structural Journal, Vol. 103, No. 5, pp. 656–663, September–October 2006.

"Shear Strength of Concrete: Another Perspective," **A.K. Tureyen** and R.J. Frosch, ACI Structural Journal, Vol. 100, No. 5, pp. 609–615, September–October 2003.

"Performance-Related Specifications for Concrete Bridge Superstructures, Vol. 3: Non-metallic Reinforcement," C.P. Mosley, **A.K. Tureyen**, and R.J. Frosch, JTRP Final Report, FHWA/IN/JTRP-2001/08-III, October 2002.

"Shear Tests of FRP Reinforced Concrete Beams Without Stirrups," **A.K. Tureyen** and R.J. Frosch, ACI Structural Journal, Vol. 99, No. 4, pp. 427–434, July–August 2002.

"Influence of Longitudinal Reinforcement Type on the Shear Strength of Reinforced Concrete Beams Without Transverse Reinforcement," **A.K. Tureyen**, Purdue University, PhD Thesis, December 2001.