Erol Tutumluer

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As professor in the Department of Civil and Environmental Engineering (CEE) at the University of Illinois at Urbana–Champaign (UIUC), Erol Tutumluer specializes in transportation geotechnics, developing an understanding of the properties and engineering behavior of the soils and rocks that support such transportation facilities as highway and airport pavements and railroad track structures. Tutumluer serves as Director of International Programs at CEE and is active in global outreach, coordinating education and research partnerships between UIUC and other institutions across the globe. He also is a Paul F. Kent Faculty Scholar.

Tutumluer has focused his research on designing and building a sustainable transportation infrastructure by applying geotechnical engineering and geomechanics principles. Geotechnical materials or geomaterials include aggregate that is bound either with asphalt or with cement to form surface layers in pavements or that is unbound and used in base or subbase pavement layers, in ballast or subballast layers of track structures, or in subgrade or roadbed soil. Geosynthetics also are used to reinforce, stabilize, drain, separate, and filter roadways and railroad track.

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"The study of transportation geotechnics provides knowledge that is key to building sustainable, long-lasting pavement and railroad track infrastructure," Tutumluer observes, adding that improved selection and appropriate use of geomaterials and geosynthetics will lead to safer, more cost-effective, and longer-lasting transportation facilities.

In his work testing and modeling pavement and railroad track geomaterials and geosynthetics, Tutumluer incorporates recent advances in materials characterization and in the application of advanced discrete and finite element methods and artificial intelligence. This creates a more accurate, mechanistic-based structural analysis and leads to better field performance.

Tutumluer currently is leading an effort to develop advanced mechanistic-based flexible pavement design and evaluation tools clustered around a public-domain, 2-D axisymmetric finite element software package for the U.S. Army Corps of Engineers' Engineer Research and Development Center. He also is conducting multiyear research projects for the Federal Aviation Administration to analyze airport pavement deformation data generated from their National Airport Pavement Test Facility under full-size multiple wheel gear loads and for North Carolina Department of Transportation (DOT) to develop better rutting models for unbound aggregate materials commonly used in the state for pavement base and subbase applications.

Aggregates constitute 70 to 100 percent by weight of all bound and unbound pavement layers in road applications; accordingly, their types and properties significantly affect the end performance. As sand and gravel mines and rock quarries are depleted or lost to other land uses, Tutumluer notes, less and less high-quality aggregate material is available—and advances in engineering practice are needed.

"Transportation projects must make better use of locally available materials through beneficiation and use of marginal aggregate materials; by increasing the effective use of recycled aggregate products, such as recycled crushed concrete and reclaimed asphalt pavement; and by conserving water and energy in pavement and railroad track construction and at the same time targeting long life and performance improvement," he muses.

For much of his 25-year engineering career—beginning with his doctoral studies at the Georgia Institute of Technology—Tutumluer has investigated structural considerations of unbound aggregate pavement layers and has developed aggregate models for the resilient and permanent deformation behavior from laboratory and full-scale testing.

Recent research projects have focused directly on pavement sustainability issues. An Illinois Center for Transportation project, sponsored by Illinois DOT, investigated the effects of aggregate type and quality—including recycled asphalt product used as aggregate—in pavement base layers and on characterization of Illinois aggregates for subgrade replacement and subbase.

"Through test-section construction and accelerated pavement testing, we are evaluating in the field large-sized aggregates and aggregate quarry byproducts to build more sustainable, longer-lasting, and resilient road infrastructure," Tutumluer comments about his most recent and ongoing research focus.

Tutumluer is an active affiliate of the Transportation Research Board (TRB) and serves as chair of TRB's Geological and Geoenvironmental Engineering Section. He is a member of the Standing Committee on Geosynthetics and, from 2011 to 2016, was chair of the Standing Committee on Aggregates. He also served as chair of the Subcommittee on Applications of Nontraditional Computing Tools Including Neural Nets. In 1999, Tutumluer received the Fred Burggraf Award for excellence in transportation research by researchers age 35 or younger.