Mohammad Hoque

Dr. Hesham Rakha

"Dr. Rakha has performed ground-breaking studies that allow the improvement of mobility in many different circumstances," said Tom Dingus, director of VTTI. "His work is unusual and very important in that he is able to simultaneously model mobility, safety and the environmental impacts of changes to the transportation system, including driver behavior."

Since his time as a graduate student, Dr. Hesham Rakha's professional influence has been based in creating travel strategies designed to assist transportation users while bearing in mind ecological impacts. As a doctoral student at Queen's University in Kingston, Canada, his dissertation, "A Simulation Approach for Modeling Real-Time Traffic Signal Controls," set the stage for a career that has encompassed the implementation of myriad intelligent transportation systems (ITS) that positively affect the motoring public and the environment.

Dr. Rakha's post-doctoral work began in 1993 when his advisor, the late Michel Van Aerde, offered him a job with M. Van Aerde and Associates. Dr. Rakha undertook his first project, which involved conducting the system-wide mobility and safety evaluations of the first large-scale field implementation of the TravTek dynamic route guidance system in Orlando, Florida. This study marked the first field implementation of a dynamic route guidance system in North America. The project entailed analyzing field data along with conducting a system-wide modeling of Orlando. This modeling study evaluated the potential benefits of a large-scale deployment of a dynamic route guidance system on transportation system efficiency and safety and on the environment.

STEVEN MACKAY

Dr. Hesham Rakha.

In 1997, Dr. Rakha was asked to join Dr. Van Aerde and work as a research scientist at the Center for Transportation Research (now the Virginia Tech Transportation Institute [VTTI]) in Blacksburg, Va. When Dr. Rakha first arrived at VTTI, he was involved in a field and modeling evaluation of adaptive cruise control systems, quantifying the safety, mobility and environmental impacts of such systems. The analysis involved studying vehicle control algorithms related to gas pedal and brake pedal control—with no control on steering—and driver behavior and adaptation to the system.

Since then, Dr. Rakha has come to serve as an assistant, associate and full professor in the Charles E. Via, Jr. Department of Civil and Environmental Engineering and the director of the VTTI Center for Sustainable Mobility. The vision of the Center for Sustainable Mobility is to establish a renowned center in the areas of sustainable transportation planning and management with emphases on mobility, efficiency, energy, the environment and safety. Dr. Rakha embodies the objectives of the center, which are to conduct applied research and to educate transportation engineers in the subject of sustainable transportation mobility.

Dr. Rakha has assisted in bringing in more than $30 million in research funding from both private industries and a host of transportation agencies that include the National Science Foundation, the National Highway Traffic Safety Administration, NAVTEQ, the Federal Highway Administration, the Mid-Atlantic Universities Transportation Center, the Virginia Department of Transportation (VDOT) and the Virginia Department for Environmental Air Quality. He has served as Principal Investigator (PI) or Co-Principal Investigator (Co-PI) for more than 80 national and international projects, including the

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current 5-year long "Connected Vehicles" project of USDOT.

Dr. Rakha's work has involved a metropolitan model deployment initiative in Seattle, Phoenix and San Antonio. As part of this effort, he developed models for adaptive traffic signal control, the use of automatic vehicle identification readers to estimate dynamic travel times that could be displayed to drivers, and the use of roadway closures on driver routing behavior. A key element of his research was the development of safety, fuel consumption and emission models for use in traffic simulation software.

Dr. Rakha oversaw a revolutionary project designed to transform VTTI's home of Blacksburg into the first real-life test facility in North America. The National Science Foundation provided $750,000 for the study, which allowed for the examination and control of traffic flow, testing of alternative means to disseminate real-time traveler information, evaluations of energy and environmental impacts of transportation projects, testing of emerging ITS technologies, and evaluations of surveillance and communication technologies.

Dr. Rakha subsequently began work for VDOT by studying trucks and their effects on traffic stream behavior along graded roadway sections. Data collection about the grade handling of trucks was conducted on the Virginia Smart Road, a 2.2-mile closed-course test bed located on-site at VTTI. As a direct result of his work, truck lanes are being added to a section of Interstate 81 (I-81) between Roanoke and Christiansburg, Va. I-81 is one of the top eight truck routes in the United States. In the state of Virginia, I-81 traverses 325.51 miles from Tennessee in the south to the West Virginia border in the north and passes through 12 counties. The highway was designed for a 15 percent truck volume. However, trucks now account for somewhere between 20 to 40 percent of the total traffic volume. Dr. Rakha and his students are currently conducting fundamental research on the impact of these slow-moving bottlenecks on traffic stream behavior.

JIM STROUP

Blacksburg, Va., was the first instrumented city in North America.

Dr. Rakha and fellow researchers within the VTTI Center for Sustainable Mobility have recently been developing eco-routing systems to recommend the most fuel-efficient routes and eco-cruise control systems designed to regulate the vehicle speed within a range set by the driver while controlling acceleration based on fuel efficiency (e.g., climbing hills slowly rather than powerfully). His team is also working on factors related to the next wave of transportation innovation: vehicle automation. Specifically, Dr. Rakha and his colleagues are examining the management of automated vehicles in close, dense platoons on highways; the control of automated vehicles at intersections; and traffic signal control strategies to minimize the system-wide delay. Dr. Rakha is also working with VDOT to predict travel times between Richmond and Virginia Beach four hours into the future. These predicted travel times will be displayed to drivers either via variable message signs or in-vehicle systems to provide drivers with better data to make better travel route and departure time decisions.

LOGAN WALLACE

Grade handling conducted on the VTTI Smart Road.

Dr. Rakha and researchers at the VTTI Center for Sustainable Mobility are working on a number of research efforts investigating the use of vehicle tracking systems to develop network-wide traffic control strategies. Specifically, in collaboration with researchers from Penn State University, Dr. Rakha and his team are investigating how real-time mobile vehicle probes can be combined with macroscopic urban traffic models to implement more efficient network-wide traffic control strategies. Additionally, this work will examine how the effectiveness of these strategies can be directly measured in the field using only mobile vehicle probe data. These two efforts

LOGAN WALLACE

VTTI's connected vehicles.

can lead to more efficient control of downtown traffic networks and a reduction in vehicular delay during rush hour periods. Dr. Rakha and his team are also developing techniques to identify bottlenecks in a transportation network and control strategies that alleviate these bottlenecks.

As a professor in the Charles E. Via, Jr. Department of Civil and Environmental Engineering at Virginia Tech, Dr. Rakha has taught classes geared towards traffic engineering, traffic control, characteristics and flow. He has advised 13 Ph.D. and 31 M.S. students to completion. As of now, he has published a total of 123 journal articles, 130 refereed conference publications, and has made more than 260 presentations at national and international conferences. He is also working with a number of students at various international institutions, including KU Leuven in Belgium, the International Islamic University of Malaysia, Qatar University and the University of Twente in the Netherlands.

In 2012, Dr. Rakha received the Best Scientific Paper Award from North America from the ITS World Congress and was the 2007 recipient of the Dean's Award for Research Excellence from the College of Engineering at Virginia Tech. In addition, he received the Dean of Engineering Faculty Fellow Award in 2004 and the Outstanding New Professor Award in 2002. He is an active member of the Professional Engineers of Ontario, the Egyptian Syndicate of Engineers, the American Society of Civil Engineers, the Institute of Transportation Engineers, the Transportation Research Board, and the IEEE.

Dr. Rakha is a member of the ITS America Benefits Evaluation and Cost Committee, the International Benefits Evaluation and Costs Co-operative Working Group, the Transportation Research Board Committees on Air Quality and Traffic Flow Theory, and the Next Generation Simulation Model Modeler Stakeholders Group. He is an expert member of the Environmental Protection Agency FACA Modeling Workgroup.

Dr. Rakha presently serves on the editorial board of *Transportation Letters: The International Journal of Transportation Research*, *IET Intelligent Transport Systems Journal*, and the *International Journal of Transportation Science and Technology*. In addition, he is an associate editor for the *IEEE Transactions of Intelligent Transportation Systems* and the *Journal of Intelligent Transportation Systems: Technology, Planning and Operations*.

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