Dr. Sadek has worked on several research projects related to transportation systems simulation and ITS. Examples of these research projects are briefly described below.

Using TRANSIMS to Model University Campuses Transportation Networks. The purpose of this project, which was funded by FHWA, was to evaluate the feasibility of using the TRANSIMS model to model transportation on college and university campuses, which offer several interesting research opportunities. The project also investigated how the TRANSIMS model can be best adapted to model such environments. The project resulted in a Track 1 TRANSIMS model of the University at Buffalo, north campus, which occupies about 1200 acres, has more than 146 buildings, and 47 parking lots. The model was calibrated by comparing the campus parking lot occupancies over time against field-observed occupancies.

Using TRANSIMS for On-line Transportation System Management during Emergencies. This project, which is currently funded by FHWA, has two primary objectives. First, the study assesses the level to which the TRANSIMS model, originally developed by Los Alamos National Lab (LANL), can be used for the online management of transportation systems during emergencies. Second, based on the assessment results, the research will develop additional functionality needed to take full advantage of TRANSIMS in emergency transportation system management. As a case study, the research is using the Buffalo-Niagara Metropolitan area which is well known for its winter weather and numerous (and sometimes severe) 'lake-effect' snow storms.

Implementing the TRANSIMS Model in Chittenden County. This project, which was funded by the U.S. DOT, FHWA, involved the deployment and calibration of the TRANSIMS model in Chittenden County, Vermont. Deploying TRANSIMS involved writing custom software to extract information from a PARAMICS model of the region and put it in TRANSIMS format. An extensive calibration process was performed to ensure TRANSIMS results agreed with observed traffic counts. Sensitivity analyses were also performed to assess the sensitivity of the model to various factors, including seed numbers and the use of actuated controllers.

Assessing the Environmental Benefits of Intelligent Intersections. Funded by UB, this project is focused on using simulation to assess the likely environmental benefits of a concept known as "intelligent intersections" in which autonomous vehicles are assigned the right of way by an intersection manager, which could in the future replace the traditional traffic signal. As vehicles approach an intelligent intersection, the vehicle broadcast its position and speed to the intersection manager in an attempt to make a "reservation" to get through the intersection. The intersection manger would then communicate to the vehicle whether its reservation have been secured, and would communicate a recommended speed for the vehicle to proceed at so as to get through the intersection without stopping. To assess the likely environmental benefits, in terms of fuel and emissions reduction, the study is modeling this concept in PARAMICS. The Comprehensive Modal Emissions Model (CMEM) developed by the University of California, Riverside, will then be used to determine the difference in total fuel consumption and emissions between the "intelligent intersection" and an optimized signalized controller.

Practicable Calibration Procedures to Enhance the Accuracy of Analytical and Micro-simulation Software for Modern Four-Legged Single-Lane Roundabouts. This project, funded by New England University Transportation Center (NETC), assessed the accuracy of three microscopic simulation models, VISSIM, PARAMICS and SimTraffic in modeling traffic operations at roundabouts in New England. Research was also conducted into how to best calibrate those models to replicate detailed traffic behavior observations at two modern roundabouts in New Hampshire.

Development and Calibration of Large-scale Microscopic Traffic Simulation Model. As a part of an NSF CAREER award, a large-scale microscopic simulation model was developed for Chittenden County in PARAMICS. The model developed is among the largest models reported in the literature for microscopic traffic simulation modeling exercises. A Genetic Algorithm was then developed and used to calibrate the model against county-wide field counts.

Using Simulation to Evaluate the Effects of Prohibiting Left-turn and the Resulting U-turn Movement. The purpose of this project, which was funded by the Ohio Department of Transportation, was to use simulation to evaluate an access management strategy that involves prohibiting left-turn movements. Three corridors were modeled using microscopic simulation, and an evaluation of the impact of left-turn prohibition was conducted.

Calibrating Traffic Simulation Models to Inclement Weather Travel Conditions with Applications to Arterial Coordinated Signal Systems. The objective of this study, which was funded by NETC, was twofold. First, the study explored how to best calibrate simulation models to inclement weather conditions in New England. This was accomplished by first determining the changes in the different traffic flow parameters resulting from inclement weather, and then adjusting the simulation models' parameters to get their results closer to reality. With the simulation models calibrated, the study then used the calibrated model to assess the benefits of developing special signal timing plans for inclement weather.

Intelligent Transportation Systems Strategic Planning at the State Level. This project, which was funded by the Vermont Agency of Transportation, resulted in the development of Vermont's first strategic ITS deployment plan. The plan identified ITS applications that are most relevant to the unique nature of the state of Vermont and the needs of its travelers. In addition, a first draft of the Statewide ITS Architecture was developed, to ensure that ITS deployment is conducted in an incremental, integrated fashion, and in conformity with the National ITS architecture.

Incorporating Intelligent Transportation Systems Deployment in Strategic Planning. The purpose of this project, which was conducted in collaboration with the University of Connecticut and was funded by NETC, was twofold. The first objective was to assess the sensitivity of the traditional four-step planning process to the likely impacts of ITS deployment. Second, the study explored how to incorporate these anticipated impacts in the planning process. A novel approach based on combining case-based reasoning (CBR), an emerging CI paradigm, and dynamic traffic assignment models (DTA) was proposed to accomplish this goal.

Development of an Intelligent Transportation Systems (ITS) Strategic Plan for Chittenden County, Vermont. The objective of this project, which was funded by Chitteden County Metropolitan Planning Organization (CCMPO) was to identify a set of ITS applications that are most appropriate for Chittenden County, Vermont, an area with a population of about 140,000. The selected applications were then combined to develop a regional ITS architecture for the County that describes how the different ITS components would interact to help solve some of the County's transportation problems. A strategic plan was also developed that describes some recommended ITS projects along with their expected benefits and costs.

Development of a Prototype Case-Based Reasoning System for Real-time Freeway Traffic Routing. This project, which was funded by the Virginia Department of Transportation, developed a prototype Case-Based Reasoning System for real-time freeway traffic routing. The system was developed to allow for routing traffic across the two major water crossing (tunnels) in the Hampton Roads area during non-recurrent congestion.