EDITORIAL

*Infrastructure Planning, Design and Management for Big Events*

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Introduction

Infrastructure networks such as transportation systems, power grids, water utilities, and communication networks are the lifelines of modern societies. National and local economies depend heavily upon efficient and reliable infrastructure networks. Further, infrastructure networks with an adequate level of service provide added value and a competitive advantage towards a region’s socioeconomic growth. The primary role of transportation infrastructure networks is to provide constant physical access to and from communities and support reliable, safe and efficient transportation of people and freight between regions. The significance of infrastructure networks is even more critical under big events such as natural and man-made disasters. The restoration of societal services is highly related to the ability of transporting resources to the regions affected by the disaster. For example, a transportation network is expected to play a significant role in disaster response by supporting relief activities and population evacuation, while its functionality has to be restored as fast as possible to accommodate rapid restoration of the area’s normal activities. The possibility of functional interdependencies between the transportation and other infrastructure networks (such as power, energy and communication) may require coordinated planning and response under big events.
Because of their ephemeral nature, special events that are big such as Olympic Games, inaugurations, large sporting events, or disasters (such as earthquakes, fires, hurricanes, oil spills, and so on), use existing and sometimes upgraded and new infrastructure that has not been conceived to absorb the intense and highly polarized usage generated by such events. Big events deal with a diversity of “exceptional” situations, the impact of which depends on their magnitude, predictability, location and regularity among other factors, and place enormous strain on most parts of infrastructure systems including transportation, telecommunications, power distribution, internet, waste generation and collection, etc. By focusing on better strategic planning and development and robust design, communities, decision makers and individuals can be more effective in making better use of existing infrastructure, better planning and design of planned infrastructure, reduce adverse impacts, share information, better utilize technology and strengthen responsibility and lines of communication.

**Overview of Papers**

The previous discussion is indicative of the attention that must be given when designing and constructing transportation infrastructure, when maintaining and managing it, and in planning and preparing for post-disaster management actions. This special issue reflects recent advances in infrastructure planning and operations for big events; papers published relate to a variety of infrastructure such as ports, airports, electric power and road networks, while methodologies employed include game theory, Bayesian networks, operations research, and statistics.

The first two papers in this special issue deal with network problems and service disruptions. In the first paper, Rigdon, Mokherjee and Friesz, investigate the topic of disruptions to transmission and generation capacity in electric power networks. They frame the problem using game theory and propose a formulation which allows for quick and effi-
cient testing of the network effects of disruptions. Their model is tested on a Northwest European electricity market, and among their results, the authors observe Braess’ paradox. The second paper dealing with the network effects of big events, in this case a natural disaster, is the work by Wolshon and McArdle that discuss regional evacuation traffic patterns during Hurricane Katrina in Southeast Louisiana. Following Hurricane Ivan’s effects on Louisiana in 2004, a plan was implemented to facilitate evacuation; the plan included extensive lane reversals, restricted access and regional coordination. This plan was tested under real-world conditions when Hurricane Katrina hit Louisiana; the authors undertake the task of describing and quantifying the effects of the implemented evacuation plan on traffic movements over a three-day period. The analysis considers both the temporal and spatial dimensions, and determines and quantifies the locations with most severe impacts, duration of these effects, as well as a useful comparison to expected results prior to the hurricane.

The next two papers deal with big event related network design and prediction issues. The work of Kalafatas and Peeta tackles network evacuation by concentrating on increasing (network) operational performance under a security threat. The authors offer a graph theoretic generalization of Daganzo’s Cell Transmission model and, using a series of experiments, discuss issues related to the model’s computational efficiency and strategies for evacuation planning and operations. While the authors find that multiple relief areas in a safety zone offers increased evacuation efficiency, they also suggest, much along the lines of Wolshon and McArdle, that predetermined and well-planned evacuation plans significantly increase effectiveness. In his work, Jha, employs dynamic Bayesian networks to predict infrastructure facility security risks, a topic of increasing interest in recent years. The author attempts to predict the likelihood of events as well as incorporates explanatory variables that may assist in improving predictions. A data intensive model is developed and tested on a USA airport; the author reports results that suggest that reliable and improved results may be obtained compared to past approaches.

The final two papers discuss infrastructure planning and operational issues related to the summer Olympic Games, possibly the World’s most infrastructure intensive sporting
event. In the paper of Yannis, Golias, Spyropoulou and Rogan, the planning of an Olympic village in a port area is discussed; the paper concentrates on the planning aspects that pertain to road traffic (including both non-transit and transit), pedestrian movements, and security considerations. The authors offer findings from an interesting and thoroughly tested case study that can assist in planning similar events in an integrated manner. The final paper, by Odoni, Stamatopoulos, Kassens and Metsovitis, discusses airport planning and operational considerations for the Olympic Games. Airports are particularly important infrastructure components in preparing for any major event, as they are called upon to offer services approaching or even surpassing design capacities, while doing so in a timely and efficient manner. The authors discuss a large number of issues related to airport planning for major events: strategic and tactical level decisions, stakeholder coordination, demand forecasts, slot management, passenger flows, facility upgradation and security.

**Concluding Remarks**

Big events, by their very nature, are complex and usually difficult to predict. However, the papers appearing in this issue clearly highlight the need for and the importance of planning, preparing and recognizing the challenges in dealing with big events. The special issue papers discuss: (i) the intricacies and difficulties in planning for predetermined big events such as the Olympic Games, (ii) the importance of well laid out evacuation plans for unforeseen natural disasters, and (iii) the need to deal with significant computational intricacies encountered in these problems. All of these papers clearly recognize the need for interdisciplinary research; computational and quantitative approaches can be an invaluable tool in optimally planning for both planned and unforeseen big events.