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Transportation Research Forum

Book Review: [Transportation Statistics](#).

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Source: *Journal of the Transportation Research Forum*, Vol. 49, No. 3 (Fall 2010), p. 159-161

Published by: Transportation Research Forum

Stable URL: <http://www.trforum.org/journal>

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Transportation Statistics

by **Bhuiyan Monwar Alam and Mohammed Abdulkaleem**

This book, edited by Brian Sloboda, should be helpful to analysts using a wide range of data sources and methods to address transportation issues and appropriate remedies. It also provides a snapshot of various technologies that have been applied in statistical analysis of transportation data in the past two decades with the help of computers and discusses the significance of these developments for areas of research in transportation data.

In the first chapter, titled “Macroscopic Road Safety Modeling: A State Space Approach Applied to Three Belgian Regions,” Van Den Bossche, Vanhoof, Wets, and Brijs discuss a state space approach which takes an account of different types of road lanes in networks such as motorways, provincial roads, and local roads, and their many properties associated with differences in road risks. The chapter develops a multivariate state space time series model based on data with its components and regression parameter estimates.

The second chapter, titled “Traffic Safety Study: Empirical Bayes or Hierarchical Bayes” by Miranda-Moreno and Fu, discusses the contrast between empirical bayes and full bayes in model parameters and accident risk estimates. The chapter suggests that full bayes are more flexible than empirical bayes for hot spot identification when working with limited observations; however, both empirical and full bays produce the same results when the amount of data is large.

Al-Deek and Emam, in the third chapter, explore the findings of a study of four random models: Weibull, Exponential, Lognormal, and Normal, and develop the best fit random model (which turns out to be Lognormal) that can be used for travel time of certain freeways. The authors argue that the existing methods are insensitive to the traveler’s outlook on travel time and that the new method is sensitive to geographical location and congestion level.

The fourth chapter, by Hess and Polak, provides an overview of parking policy and its importance in travel demand management. Based on research on several city centers in the United Kingdom using a mixed multinomial logit (MMNL) model—which has the capacity to accommodate randomness and variety in travelers’ taste—the authors conclude that variety in tastes is an important factor that can lead to different conclusions in terms of accessibility, time, and fines for illegal parking. The chapter also discusses technical issues related to heterogeneity, which is very significant in applying the MMNL model.

Cools, Moons, and Wets, in the fifth chapter titled “Modeling Daily Traffic Counts: Analyzing the Effects of Holidays,” consider different modeling approaches to analyze daily traffic counts using the effects of holidays, which is an emerging area of research. The authors focus on two major issues. First, they use exponential smoothing and ARMA models for forecasting daily traffic counts and correlating successive traffic counts. The chapter provides a firm base to forecast future traffic counts. Second, the regression model presupposes that the daily traffic counts can be explained by other variables and focuses on a thorough check of holiday and day of week effects. Analysis is performed on the data collected from single inductive loop detectors, which conclude that weekly cycles influence the variability of traffic counts. The Box-Tiao model approach demonstrates that during holidays, the daily traffic flows are significantly lower. This model appears to perform reasonably well when daily traffic flow forecasts are required.

Chapter Six, by Metaxatos, focuses on the problems faced by transportation planners estimating and validating house trip generation rates from a small-scale household travel survey. It addresses three major problems: i) unusual observations, which are identified by traditional methods, ii) small number of observations, which are identified by classification and regression tree analysis, and

iii) missing observations, which are addressed using row column decomposition analysis. The author demonstrates these three problems using a small scale household travel survey and argues that the same procedures can be easily implemented with resources available to transportation analysts in Metropolitan Planning Organizations (MPOs).

There is significant progress in activity based micro-simulation of traditional travel demand. Mohammadian, Auld, and Yagi discuss these recent developments in Chapter Seven. They describe the traditional four-step travel demand models that make up the majority of models used in practice. They also describe activity based models, provide an overview of statistical procedures adopted in various models, and indicate further improvements in model techniques, validation, and transferability.

In Chapter Eight, which examines several simulation methods used in a variety of empirical analyses, Wang and Kockleman, suggest the use of pseudo-random Monte-Carlo (PMC) over quasi-Monte Carlo (QMC) and hybrid methods even when observations are correlated because of their better coverage.

The aftermath of the closure of the Glion Tunnel for repairs is discussed in Chapter Nine. Issues such as loss in tourism economy due to closures are addressed by Harvey's structural time series model. It uses indigenous variables, monthly series of tourism overnights, exogenous variables, and transportation data with monthly frequency. The chapter shows the differences in behavior before and after the closing of the tunnel. Scaglione uses the Chow test to identify break points and to determine approximate moments that become significant with behavioral changes. Morris provides an application of generalized linear models with maximum quasi-likelihood estimation to motor vehicle fatalities. The chapter deals with motor vehicle fatality risk as it varies in complex ways with interacting human, vehicle, and environmental factors. It explains the use of generalized linear models and quasi-likelihood estimation in analyzing motorcycle fatality rates (where use of helmets is required by law) while controlling for two climatic measures (using annual number of days of high heat and inches of precipitation as statistical proxies for residual variation in motorcyclist activities).

The research by Liu and Deng explores travel patterns during weekends. Applying a holistic approach, the researchers examine unique characteristics of weekend travel, evaluate travel survey data, and develop specifications for a statewide travel demand forecast model that can be included in existing long-range transportation planning (LRTP) processes at both metropolitan and state levels. Jin and Horowitz, on the other hand, discuss time-of-day models that deal with time at which travel occurs throughout the day. They present a study in time-of-day choice modeling for long distance trips with focus on transferability of models. The results indicate that departure time choice for long, occasional, and exceptional trips is more complicated than for urban short trips. Jin and Fricker, in the last chapter of the book, examine uncertainty as it applies to statewide travel-demand forecasting and land use models. The study investigates the sensitivity of Vehicle Miles Traveled (VMT) outputs to model parameters and input data using Indiana's statewide INTRLUDE model system.

This book provides a knowledgeable application of statistical and econometric methods to transportation data used in ongoing research. It gives priority to applied processes and describes how these methods can be successfully used and interpreted. It also provides awareness into the variety of data collection sources used in statistical analysis, interprets results, and analyzes the implication of those results. In terms of merit, this book stands alongside some other books on the subject matter – *Transportation Statistics and Micro-Simulation* by Spiegelman, Park, and Rilett, and *Statistical and Econometric Methods for Transportation Data Analysis* by Washington, Karlaftis, and Mannering. It is worth reading this book for a better understanding of transportation data analysis using statistical techniques that are specifically applicable to transportation.

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