MONASH University
Engineering

Postgraduate Program in Transport and Traffic

CIV5303: Quantitative Methods

Background and Aims

Decisions about the planning, design and management of safe and efficient transportation systems depend on robust and reliable information. For instance planning of a new freeway requires information including current and future travel options, existing and predicted travel demand, predicted funding availability and a survey of public attitudes about the project. Evaluating which intersection improvements should be funded requires information such as turning volumes, accident rates and vehicle emissions estimates. A pavement management program requires pavement performance information such as roughness, cracking, current and predicted traffic volumes and percentage of trucks. These examples illustrate that information (and hence the decision-making process) is tied to the effective collection, presentation, description, analysis and interpretation of *data*. The implications are that traffic and transportation professionals must have a solid understanding of the field of *statistics,* which by definition is a set of principles and procedures for collecting, describing and drawing inferences from data.

After completing this unit participants will know:

- why quantitative methods are fundamental to traffic and transportation analyses
- how to describe, present and assess the quality of transportation data using visual and statistical techniques
- how to formulate hypotheses and infer information about a population from a sample of that population
- how to build and assess the robustness of statistical models to forecast future travel conditions under various scenarios

Details of the structure of the unit are provided over the page

Enrolment Options

Enrol as a single unit or as part of either the Graduate Certificate in Transport and Traffic, Postgraduate Diploma in Transport and Traffic, or Masters in Transport and Traffic.

Off-Campus Study Mode

This unit is offered by Off-Campus (distance education) and there is no requirement for participants to attend lectures. Study guides, comprising a comprehensive set of course notes, are sent following enrolment. Further support is provided through a unit web site and via e-mail. The lecturer is available to answer questions and to provide assistance as necessary throughout the semester. Assistance can be arranged by email, facsimile, mail, telephone or through the discussion groups on the unit web site. Assessment comprises two assignments and an examination (worldwide exam venues are available).

Unit Co-ordinator

Majid Sarvi graduated as a Civil Engineer and received his master and PhD in Traffic and Transportation Engineering. Majid worked for a few years at Tokyo University where his research focussed on Intelligent Transport System. Majid joined Monash University in 2003.

Enrolment or General Course Enquiries:

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Offered through **The Institute of Transport Studies, Department of Civil Engineering**
Faculty of Engineering, Monash University

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Structure

The unit is structured around 11 topics which are generally associated with one week of study

Topic	*After completing this topic, participants will:*
1. Data Statistics	• understand the types of data encountered in transportation studies • have knowledge of different data sources and how they are collected • understand the sources of and implications of data errors
2. Examining Your Data (2 weeks)	• understand the importance of a systematic preliminary examination of transportation data • be able to use visual methods and descriptive statistics to describe transportation data, identify outliers, assess whether data meets required statistical assumptions, and identify relationships between variables • be able to present data in a form that can be easily synthesised by others.
3. Probability and Discrete Probability Distributions	• understand the importance of probability theory in statistical analyses • know the major discrete theoretical probability distributions used in transport studies and their applications • be able to apply and interpret tests to assess the goodness-of-fit of your data to theoretical probability distributions
4. Continuous Probability Distributions and Sampling Distributions	• know the major continuous theoretical probability distributions used in transport studies and their applications • understand the formulation and importance of the normal distribution • understand the concept and importance of sampling distributions for statistical inference
5. Introduction to Statistical Inference	• be able to frame transportation issues and problems as statistical hypotheses (e.g., how do we assess whether imposition of speed cameras have reduced travel speeds? How can we evaluate public attitudes to a new freeway?) • know the different errors associated with hypothesis testing and how to manage them • make statements about the level of confidence in estimates • be able to calculate required sample sizes for transportation and traffic surveys
6. The One and Two-Sample Set-Up	• know how to compare critical parameters (means, variances, proportions) from one sample against a hypothesised value • know how to compare parameters from two samples drawn from independent and dependent populations • be able to test for violations of statistical assumptions that are required to use these tests
7. The Analysis of Variance (2 weeks)	• be able to apply and interpret the Analysis of Variance (ANOVA) procedures to compare means across one or more categorical variables (e.g., How do trip rates vary by household size? What factors affect driving speeds?) • know how to interpret the main effects and interaction effects from an ANOVA procedure • be able to set-up and interpret pre-planned comparisons (contrasts) and post-hoc comparisons of means
8. Categorical Data Analysis	• be able to apply and interpret techniques to analyse categorical transportation data • understand why traffic engineers are interested in modelling performance characteristics (e.g., speeds, headways) with theoretically based distributions such as the normal and negative exponential
9. Simple Linear Regression	• develop relationships using regression that provide predictions of transportation system behaviour based on other variables • be aware of the assumptions that underlie these models and how to control for them
10. Multivariate Regression	• know how to extend the techniques of simple linear regression to consider multiple independent variables • interpret the performance of the regression model and the relative importance of each variable
11. Other Statistical Techniques used in Transport Analyses	• be aware of other useful techniques for traffic and transportation analyses