Background and Aims

The student is expected to develop an understanding of basic statistical procedures, an approach for integrating data analysis and graphical methods, the model development procedure, least squares regression, the interpretation of behavioural modelling techniques and time series analysis.

After completing this unit participants will know:

- why quantitative skills are fundamental requirements for modern traffic and transportation professionals,
- how to "translate" a traffic engineering of general engineering problem into a probability problem and accordingly build a probabilistic model to solve the problem,
- how statistical methods enable us to infer characteristics of a data population based on a sample of that population, and
- how to build and assess the robustness of statistical models that can be utilised for predicting/forecasting future travel conditions under various scenarios.

Off-Campus Study Mode

The program is taught by off-campus learning which means you can balance your work and study while attaining your qualification with Monash University. There are no classes to attend so you can study where and when you like. Students from all over the world study in the postgraduate program, thanks to its flexible off-campus learning mode. Students and graduates can be found throughout Australia, New Zealand, the Middle East, Europe, North America and Africa.

A combination of printed study material and electronic communications are used in the delivery of the program. Academic assistance can be obtained by email or telephone. Discussion groups and other forms of on-line communication are also available for communicating with staff and other students.

Unit Co-ordinator

Amir completed his BSc in Civil Engineering at Ferdowsi University of Mashhad and graduated with MSc in Road and Transportation Engineering from the same university. Amir has been a member of the ITS (Monash) team for a number of years and recently submitted his PhD. He has extensive experience in statistics and he has been involved in the group’s teaching activities at Monash University since 2008.

Enrolment Options

Enrol in either the Master of Transport or Master of Traffic or as a single unit. Exit options are also available for the Graduate Certificate in Transport and Traffic or the Graduate Diploma in Transport and Traffic.

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

Enrolment or General Course Enquiries:
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### Structure

**The unit is structured around 10 topics which are generally associated with one week of study**

<table>
<thead>
<tr>
<th>Topic</th>
<th>After completing this topic, participants will have knowledge of:</th>
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| 1. Data Types, Data Sources and Data Errors | • Basic statistical terminology.  
• The types of data encountered by transportation and traffic professionals.  
• How to classify data variables.  
• Survey and sampling techniques for acquiring transportation data.  
• Survey data reliability. |
| 2. Examining Your Data | • 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 basic concepts and terminologies of probability theory.  
• Know the major discrete theoretical probability distributions used in transport studies and how to apply them.  
• Know how to assess the goodness-of-fit of empirical data to a theoretical probability distribution. |
| 4. Continuous Probability Distributions and Sampling Distributions | • Understand the formulation and importance of the normal distribution.  
• Be able to determine normal probabilities.  
• Test whether your data follow a continuous probability distribution.  
• Understand why knowledge of sampling distributions enables us to make statistical inferences from sample data. |
| 5. Introduction to Statistical Inference | • Formulate statistical hypotheses to address questions about observed behaviour.  
• Develop a systematic process for testing hypotheses.  
• Interpret the results of a hypothesis test.  
• Understand the different types of error in hypothesis testing and how to manage them.  
• Estimate unknown parameters and make statements about our level of confidence in these estimates.  
• Calculate required sample sizes to estimate population parameters to pre-specified levels of precision. |
| 6. The One and Two-Sample Set-Up | • Draw inferences on the mean of one population when the population variance is unknown.  
• Draw inferences on the proportion and variance of one population.  
• Draw inferences on the difference in means and variances between two unrelated and related populations.  
• Test for violations of statistical assumptions that are required to use these tests.  
• Set up and interpret the statistical tests in the statistical software of your choice. |
| 7. The Multi-Sample Set-up and the Analysis of Variance (ANOVA) | • Apply and interpret the one-way/single factor ANOVA to compare means across one factor.  
• Apply and interpret the multi-way ANOVA to compare means across all levels of two or more factors.  
• Interpret the main effects and interaction effects from an ANOVA procedure.  
• Set-up and interpret pre-planned comparisons (contrasts) and post-hoc comparisons of means.  
• Establish whether your data meet the statistical assumptions required for the ANOVA procedures. |
| 8. Categorical Data Analysis | • Understand the difference between the χ² test for the difference in two proportions and the χ² test for independence.  
• Apply and interpret the χ² test for independence to binomial and multinomial populations.  
• Understand the limitations of the χ² test.  
• Understand, apply and interpret Correspondence Analysis [Note, this is not covered in the text but a search online will bring up several useful references]. |
| 9. Simple Linear Regression | - Understand when the research question can be addressed using regression.  
- Identify an appropriate regression model for your data from scatter diagrams.  
- Apply the least-squares method to build a regression model.  
- Determine whether your data meet the assumptions required.  
- Interpret the output from a regression analysis.  
- Use a regression model for estimation of unknown parameters and prediction of individual values. |
| 10. Multiple Regression | - Understand when the research question can be addressed using multiple regression.  
- Identify appropriate regression models for your data from scatter diagrams.  
- Apply the stepwise method to build a regression model.  
- Determine whether your data meet the assumptions required through residual analysis.  
- Determine the statistical significance of a regression analysis.  
- Determine the strength of the regression relationship and the relative contribution of each independent variable  
- Use a regression model for estimation of unknown parameters and prediction of individual values. |

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