

Course Number	554 (Graduate)
Title	INTRODUCTION TO MULTIMODAL TRANSPORTATION ENGINEERING DATA ANALYSIS
Section	001
CRN(s)	10571 (Graduate)
Credits	4
Prerequisite(s)	Graduate Standing or Instructor Permission
Days/Time	Tuesday 12:00 PM to 2:50 PM
Location	EB325/EB315
Final Exam Day/Time	No Final Exam – Poster or Presentation During Exam Period
Instructor	Dr. Christopher M. Monsere, P.E.
Office	301B Engineering Building
Phone	503-725-9746
E-mail	monsere@pdx.edu
Office Hours	Wednesday 11-12:00PM , others by appointment
Mailbox Location	CEE Office, Engineering Building Room 200

Required Text:

1. Keen, Kevin. *Graphics for Statistics and Data Analysis with R*. CRC Press, Taylor and Francis Group, 2010
2. Dalgaard, Peter. *Introductory Statistics with R*. 2nd ed., Springer Science 2008.
3. Monsere, C. Understanding and Communicating Multimodal Transportation Data. Pacific Crest, Plainfield IL. ISBN 978-1-60263-440-4. <http://transportation-data.com/>

Other Materials:

Washington, S., Leonard, J., Manning, D. G., Roberts, C., Williams, B., Bacchus, A. R., Devanhalli, A., Ogle, J., Melcher, D. *Scientific Approaches to Transportation Research Volumes 1 and 2*. NCHRP 20-45, 2002. <http://onlinepubs.trb.org/Onlinepubs/nchrp/cd-22/start.htm>.

Catalog Course Description

An introduction to multimodal transportation engineering data sets through applied analysis and visualization techniques. The course includes an overview of data types, techniques for graphical analysis of data, and exposure to common software and statistical tools and visualizations in transportation engineering.

Course Statement

This gateway course; the knowledge gained in this course will be applied throughout the remaining graduate curriculum. This course will introduce students to appropriate research methods for using transportation data sets and communicating the results of their work to a broad audience. The course content includes:

- (a) managing, extracting, and filtering large-scale data
 - a. dimensions of data – time resolution, space, aggregation
- (b) techniques for visualizing data and exploratory analysis and
- (c) basic statistical analysis applied to transportation problems (public transportation, traffic, probe vehicles, safety, freight) which will involve use of common software and statistical tools (R, Excel) and databases (postgresSQL).
- (d) hypothesis design and testing,
- (e) selection of appropriate analysis technique

- (f) presentation of material in a technical summary

Learning Objectives

Learning objectives are categorized by competencies, movement, experience and integrated performance categories.

Competencies

1. Explain and identify the basic types of data (continuous, discrete, nominal, ordinal) and variable types (independent, dependent, categorical)
 - a. What does this mean for analysis
 - b. How to present these data
 - c. Be able to select appropriate tool
2. Construct simple and complex SQL queries to extract data from large scale RDMS
 - a. Data filtering process
 - b. SQL
 - c. Filling in missing data
 - d. Preparing the data before analysis
3. Make judgments about the correlation between one or more variables (using linear regression)
4. Use exploratory techniques to identify outliers and “bad” data

Movement

1. Formulating inquiry questions to understand and describe the data
2. Increase programming proficiency in R including skills and logic to develop and implement scripts and algorithms
3. Apply visualization techniques to gain understanding of large-scale data.
4. Select and conduct appropriate statistical tests to test hypothesis at different levels of significance.
 - a. Hypothesis testing (define scope of type of tests)
 - b. Understanding the assumptions of various statistical tests
 - c. Distribution fitting
5. Prepare a summary of analysis (including graphics) for technical audience.

Experience

1. Receiving feedback on a group project from peer reviewers.
2. Communicating ideas and knowledge via various mediums (in-person spoken, written, web-based).
3. Active exploration of interacting with transportation data archives to answer authentic problems.

Integrated performance

1. Use data analysis, hypothesis testing, and visualization tools to answer and explain complex transportation problems.

Assessment is done by evaluating activities

	Competency	Movement	Experience	Accomplishment	Integrated Perf.
Reading (Participation)	X				
Quiz (Participation)	X				
Active Lectures (Participation)	X				
Annotated Code	X				
Peer Assessment	X				
Short Response		X	X	X	
Discovery		X	X	X	
Final Project			X		X

Course Evaluation

The course grade will be determined with the following weight for class assignments:

- *Participation Activities (10%)*
 - *These activities require quick assessment and feedback. You will receive credit for completing these activities.*
- *Annotated Code Activities (5%)*
 - *In these activities you be asked to only submit a script or code file that contains comments and demonstrates active exploration of the objectives within the activity.*
- *Peer Assessment Activities (5%)*
 - *Some activities will require you to assess the work of your fellow students. In these activities, your performance will be based on your work assessed by the instructor, your feedback to peers, and your peers' assessment of your work.*
- *Short Response Activities (20%)*
 - *Many activities are structured such that you respond to a set of questions. You will receive credit both for completing these activities and for the depth and detail of your responses. We will attempt electronic submittal and feedback for these activities.*
- *Discovery Activities (30%)*
 - *These activities require you to build on knowledge and skills introduced to you in previous activities. These activities will be open ended and you will receive credit for completing these activities and for the creativity of your exploration.*
- *Final Project (30%)*
 - *A final independent structured analysis will be selected by the student from a set of open-ended questions devised by the instructor. This project will serve as the final assessment that the student has made progress in developing knowledge and skills in this class. The project is due during the final exam period, where students will make a brief presentation on their results to the class.*

A grade of incomplete "I" is granted by the instructor *only* with prior approval and consent. Criteria are outlined in the PSU Bulletin.

Expectations of the Student

Professionalism

All assignments and class participation should be conducted in a professional manner. Attention to detail on class assignments and communication is important and is part of student evaluation.

Late Work

The due date for each assignment is clearly indicated and the work must be turned in at the start of class unless indicated otherwise. Late assignments will be penalized between 5% and 10% of the total points (decided on case-by-case basis). There will be no credit if an assignment has already been returned.

Computer and E-mail Accounts

You should obtain and CECS account as soon as possible to be able to use computer resources. You will need to secure a PostgreSQL account. If you send me an email, I ask that you include CE554 and topic of your message in the subject line (be as specific as possible, use proper grammar, spell check, and proof read your message. **Before you ask a question, please do due diligence and try to find the answer yourself.**

Ethics and Professionalism

As future professional engineers you should plan to take the Fundamentals of Engineering Exam (if you haven't already) and after the required experience, the Professional Engineering Exam (see the Oregon State Board of Examiners for Engineering and Land Surveying at www.osbeels.org). You should also be familiar with the ASCE Code of Ethics (www.asce.org/inside/codeofethics.cfm), which includes the following:

Engineers shall act in such a manner as to uphold and enhance the honor, integrity and dignity of the engineering profession.

The PSU Student Conduct Code prohibits all forms of academic cheating, fraud, and dishonesty. Further details can be found in the PSU Bulletin. Allegations of academic dishonesty may be addressed by the instructor, and/or may be referred to the Office of Student Affairs for action. Acts of academic dishonesty may result a failing grade on the exam or assignment for which the dishonesty occurred, disciplinary probation, suspension or dismissal from the University. Questions about academic honesty may be directed to the Office of Student Affairs (www.ess.pdx.edu/osa/).

Resources

Student Groups and Professional Organizations

Participation in student and professional groups can be a valuable part of your education experience. Membership gives students opportunities to get to know fellow students better, meet and network with professionals, collaborate in solving real engineering problems, learn about internship or job possibilities, socialize and have fun. Your fellow students can be a great source of help and guidance in your academic endeavors. Consider becoming active with a student organization, such as the following:

- American Society of Civil Engineers Student Group (ASCE): www.asce.pdx.edu
- Institute of Transportation Engineers Student Chapter (ITE): step.cecs.pdx.edu

Most professional organizations have monthly meetings and encourage student participation by providing discounts for lunch and dinner meetings. These meetings provide opportunities to network with potential future employers, learn about scholarships, and increasing your technical knowledge. Take a look at these organizations as a starting point:

- American Society of Civil Engineers (ASCE) Oregon Section: www.asceor.org
- Institute of Transportation Engineers (ITE) Oregon Section: www.oregonite.org
- Society of Women Engineers (SWE) Columbia River Section: www.swe-columbia-river.org
- Structural Engineers Association of Oregon (SEAO): www.seao.org

Campus Help

As a PSU student, you have numerous resources at your disposal. Please take advantage of them while you are here. A small sample is listed below:

- CEE Website (includes program info, job listings, etc.): www.cee.pdx.edu
- Career Center: www.career.pdx.edu/
- Center for Student Health & Counseling: www.shac.pdx.edu/
- The Writing Center: www.writingcenter.pdx.edu/
- PSU Disability Resource Center: The PSU Disability Resource Center is available to help students with academic accommodations. If you are a student who has need for test-taking, note-taking or other assistance, please visit the DRC and notify the instructor at the beginning of the term.

Campus Safety

The University considers student safety paramount. The Campus Public Safety Office is open 24 hours a day to assist with personal safety, crime prevention and security escort services. Call 503-725-4407 for more information. For Campus emergencies call 503-725-4404.

Final Notes

- The syllabus is subject to change at the discretion of the instructor as course or other circumstances requires.
- Students with documented disabilities are encouraged to discuss with me arrangements that will enhance their learning in this class.

- Please feel free to discuss with me problems/concerns with your other classes.