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## Geography 549: Topics in Geography of Transportation

### - Geographic Information Systems for Transportation

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- **Course number:** GEOG 549 (3 credit hours, CRN 35458)
- **Class location:** Burchfiel Geography Building (BGB), Room 404
- **Class time:** 2:30 - 3:45 pm (Tuesdays and Thursdays)
- **Instructor:** Shih-Lung Shaw, Professor
- **Office:** Burchfiel Geography Building (BGB), Room 317
- **Office hours:** Thursdays at 1:30 - 2:30 pm or by appointment
- **Contact information:** Email: [sshaw@utk.edu](mailto:sshaw@utk.edu), Phone: 865-974-6036

#### Class Website

- Class website is available at Canvas. You can access Canvas at <https://oit.utk.edu/instructional/tools/online/canvas/default.html>

#### Textbooks

- Harvey Miller and Shih-Lung Shaw. 2001. *Geographic Information Systems for Transportation: Principles and Applications*. New York: Oxford University Press (ISBN: 0195123948). (Note: This book is optional and is recommended for reference purpose only. A copy of this book is available at UT's John C. Hodges Library.)
- TransCAD User's Guide, TransCAD Travel Demand Modeling User's Guide, TransCAD Routing and Logistics User's Guide, and TransCAD Help for Caliper's TransCAD software. (Note: All of these TransCAD documents are available under the "Help" menu option in TransCAD software. All students are expected to learn how to use TransCAD by reading these documents.)

#### Course Description

This course covers select transportation topics such as shortest path and routing, network flows, facility location, and travel demand analysis. In addition, this course is designed as a Geographic Information Systems for Transportation (GIS-T) class, which has a focus on how geographic information systems (GIS) can be used in support of various transportation applications. Students will use TransCAD in this class to gain hands-on experience with GIS-T software. ArcGIS also will be demonstrated in this class when appropriate. The main course objective is to prepare students with an understanding of select transportation topics and the relevant GIS-T concepts and functions.

#### Central Learning Objectives

Students who successfully complete this class are expected to gain the following knowledge/experience:

- Know select transportation topics and analysis methods;
- Understand the key concepts of geographic information systems for transportation; and
- Gain knowledge and hands-on experience of using GIS software to tackle real-world transportation problems.

#### Degree Learning Objectives

- Students will gain in-depth knowledge of transportation geography as well as ability in critical thinking and communication.
- Students will be able to use knowledge in geographic information science to ask sound research questions, select suitable analysis methods for transportation problems, and explain the analysis results properly.
- Students will be able to apply knowledge and skills in transportation and geographic information science to address specific theoretical and/or practical geographic problems.

### Prerequisites and Other Important Notes

- Basic knowledge and technical skills of geographic information systems (GIS) equivalent to GEOG 311 (Geovisualization and Geographic Information Science) are expected.
- This course includes hands-on work with computer software. Students should feel comfortable with the following computer skills and tasks:
  - Communications via email,
  - Information search via Internet browsers,
  - Use of the Microsoft Word and Powerpoint,
  - Working with zip files,
  - Working with Canvas and Zoom, and
  - Learning new computer software, including TransCAD and ArcGIS
- Most course materials will be posted on UT's Canvas website. Students are expected to access the course website on a regular basis and feel comfortable of working with Canvas.
- Students are expected to attend classes and participate in class discussions.
- Each student must have at least two USB flash drives (each with >1GB capacity) to store class work.
- All assignments must be completed on time. A 10% penalty per calendar day will be assessed toward assignments that are turned in late.
- No make-up course work will be allowed except for legitimate excuses with appropriate documents (e.g., a doctor's statement) submitted to the instructor. Except for death in the family, serious illness or special situations, there will be no incomplete.
- The Department of Geography and Sustainability does not allow individual students to perform extra credit work in order to increase their grade. Any extra credit options must be made available to the entire class.
- Students who feel they may need an accommodation based on the impact of a disability should contact the Student Disability Services (SDS) at 865-974-6087 in 100 Dunford Hall to document their eligibility for services. Student Disability Services will work with students and faculty to coordinate reasonable accommodations for students with documented disabilities.
- Cheating, plagiarism, and other forms of academic dishonesty will not be tolerated.
- It is important to recognize that the classroom is an environment that requires respect for all participants. Therefore, students are expected to conduct themselves in a considerate manner. All participants in the class must respect the classroom environment by being on time, turning off cell phones, avoiding extraneous talking and chat, and refraining from reading non-class material.

### Grading System

1. Class attendance and participation: 15%
  - Students are expected to attend classes and actively participate in class discussions.
2. TransCAD tutorials: 35%

- Students are expected to complete tutorials in TransCAD User's Guide and in TransCAD Routing and Logistics User's Guide for the chapters listed in the Course Schedule section below. All completed tutorials must be saved on a USB flash drive according to the instructions provided by the instructor. You must submit all relevant tutorial files to the instructor by the date/time specified in the Course Schedule section below. Students are expected to work on these tutorials outside the class meeting hours.
- 3. Lab assignments: 20%
  - There will be three lab assignments. All completed assignments must be saved on a USB flash drive according to the instructions provided by the instructor. You must submit all relevant folders/files in a zip file and email the zip file as an attachment to the instructor at [sshaw@utk.edu](mailto:sshaw@utk.edu) by the due dates/time listed in the Course Schedule section below. Students are expected to work on these lab assignments outside the class meeting hours.
- 4. GIS-T application project: 30%
  - Each student will choose a specific GIS-T application and implement it with TransCAD software. School bus routing, delivery truck routing, locating warehouses or fire stations, transit information system for Knox County are some examples of possible GIS-T application topics. Each student will be responsible for data collection, GIS database creation, GIS application development, and a 10-minute Powerpoint presentation/live demonstration. You must email a Word document of single-spaced, two-page project proposal to the instructor at [sshaw@utk.edu](mailto:sshaw@utk.edu) by the date/time specified in the Course Schedule section below. Final project presentations and demonstrations are scheduled at 10:00 AM - 12:15 PM on Thursday, May 11, 2023. All project data and files that can be readily opened in TransCAD must be submitted to the instructor at [sshaw@utk.edu](mailto:sshaw@utk.edu) by 10 AM on Thursday, May 11, 2023. In addition, a project report (single-spaced, up to 5 pages), which includes descriptions of the project, data sources, analysis methods, analysis results, and major challenges encountered during the project, must be emailed to the instructor ([sshaw@utk.edu](mailto:sshaw@utk.edu)) by 10 AM on Thursday, May 11, 2023.

Final course letter grades will be determined as follows:

- A:  $\geq 93\%$ , A-: 90-92%, B+: 87-89%, B: 83-86%, B-: 80-82%, C+: 77-79%, C: 73-76%, C-: 70-72%, D: 60-69%, F: < 60%

## Course Schedule

Week/Dates	Topics	TransCAD Tutorials	Notes
1 (1/24, T)	<ul style="list-style-type: none"> <li>▪ Course syllabus</li> <li>▪ Lab instructions</li> </ul>		
2 (1/26, R)	<ul style="list-style-type: none"> <li>▪ Introduction to GIS-T (Miller &amp; Shaw, Chap. 1)</li> </ul>	TC-UC: C. 1-2	
3 (1/31, T)	<ul style="list-style-type: none"> <li>▪ GIS-T Data Representations (Miller &amp; Shaw, Chap. 2-4)</li> </ul>	TC-UC: C. 3-5	
4 (2/2, R)	<ul style="list-style-type: none"> <li>▪ GIS-T Data Representations (Miller &amp; Shaw, Chap. 2-4)</li> </ul>	TC-UC: C. 6-8	
5 (2/7, T)	<ul style="list-style-type: none"> <li>▪ Shortest Path Problem, Traveling Salesman Problem (TSP), and Vehicle Routing Problem (VRP) (Miller &amp; Shaw, Chap. 5 &amp; 11)</li> </ul>	TC-UC: C. 9-10	
6 (2/9, R)	<ul style="list-style-type: none"> <li>▪ Shortest Path Problem, Traveling Salesman Problem (TSP), and Vehicle Routing Problem (VRP) (Miller &amp; Shaw, Chap. 5 &amp; 11)</li> </ul>	TC-UC: C. 11-12	* Submit a USB flash drive with TransCAD tutorials of TC-UC Chapters 1-10 by 2:30 PM today (February 9, 2023)
7 (2/14, T)	<ul style="list-style-type: none"> <li>▪ Shortest Path Problem, Traveling Salesman Problem (TSP), and Vehicle Routing Problem (VRP) (Miller &amp; Shaw, Chap. 5 &amp; 11)</li> </ul>	TC-UC: C. 13-14	
8 (2/16, R)	<ul style="list-style-type: none"> <li>▪ Shortest Path Problem, Traveling Salesman Problem (TSP), and Vehicle Routing Problem (VRP) (Miller &amp; Shaw, Chap. 5 &amp; 11)</li> </ul>	TC-UC: C. 15 TC-RL: C. 1	* Lab assignment #1 handout
9 (2/21, T)	<ul style="list-style-type: none"> <li>▪ Shortest Path Problem, Traveling Salesman Problem (TSP), and Vehicle Routing Problem (VRP) (Miller &amp; Shaw, Chap. 5 &amp; 11)</li> </ul>	TC-RL: C. 1	
10 (2/23, R)	<ul style="list-style-type: none"> <li>▪ Linear Referencing and Dynamic Segmentation (Miller &amp; Shaw, Chap. 3)</li> <li>▪ Work on TransCAD tutorials</li> </ul>	TC-UC: C. 16-17	* Lab assignment #1 due by 2:30 PM today (February 23, 2023)
11 (2/28, T)	<ul style="list-style-type: none"> <li>▪ Complete TransCAD tutorials of TC-UC Chapters 11-17 &amp; TC-RL Chapter 1 (<b>No Class Meeting</b>)</li> </ul>		
12 (3/2, R)	<ul style="list-style-type: none"> <li>▪ Linear Referencing and Dynamic Segmentation</li> </ul>	TC-UC: C. 16-17	

	(Miller & Shaw, Chap. 3)		
13 (3/7, T)	<ul style="list-style-type: none"> <li>▪ Linear Referencing and Dynamic Segmentation (Miller &amp; Shaw, Chap. 3)</li> </ul>	TC-UC: C. 16-17	* Lab assignment #2 handout
14 (3/9, R)	<ul style="list-style-type: none"> <li>▪ Network Flow Modeling and Facility Location Problems (Miller &amp; Shaw, Chap. 6 &amp; 11)</li> </ul>	TC-RL: C. 3, 5	
15 (3/14, T)	<ul style="list-style-type: none"> <li>▪ <b>SPRING BREAK (NO CLASS)</b></li> </ul>		
16 (3/16, R)	<ul style="list-style-type: none"> <li>▪ <b>SPRING BREAK (NO CLASS)</b></li> </ul>		
17 (3/21, T)	<ul style="list-style-type: none"> <li>▪ Network Flow Modeling and Facility Location Problems (Miller &amp; Shaw, Chap. 6 &amp; 11)</li> </ul>	TC-RL: C. 3, 5	* Lab assignment #2 due by 2:30 PM today (March 21, 2023)
18 (3/23, R)	<ul style="list-style-type: none"> <li>▪ Work on application project proposal (<b>AAG Meeting, No Class Meeting</b>)</li> </ul>		
19 (3/28, T)	<ul style="list-style-type: none"> <li>▪ Network Flow Modeling and Facility Location Problems (Miller &amp; Shaw, Chap. 6 &amp; 11)</li> </ul>	TC-RL: C. 3, 5	
20 (3/30, R)	<ul style="list-style-type: none"> <li>▪ Network Flow Modeling and Facility Location Problems (Miller &amp; Shaw, Chap. 6 &amp; 11)</li> </ul>	TC-RL: C. 3, 5	* Each student must email a GIS-T application project proposal to the instructor ( <a href="mailto:sshaw@utk.edu">sshaw@utk.edu</a> ) by 2:30 PM today (March 30, 2023).
21 (4/4, T)	<ul style="list-style-type: none"> <li>▪ Network Flow Modeling and Facility Location Problems (Miller &amp; Shaw, Chap. 6 &amp; 11)</li> <li>▪ <b>Class meeting via Zoom</b></li> </ul>	TC-RL: C. 3, 5	
22 (4/6, R)	<ul style="list-style-type: none"> <li>▪ <b>NO CLASS DAY</b></li> </ul>		
23 (4/11, T)	<ul style="list-style-type: none"> <li>▪ Network Flow Modeling and Facility Location Problems (Miller &amp; Shaw, Chap. 6 &amp; 11)</li> </ul>	TC-RL: C. 3, 5	
24 (4/13, R)	<ul style="list-style-type: none"> <li>▪ Network Flow Modeling and Facility Location Problems (Miller &amp; Shaw, Chap. 6 &amp; 11)</li> </ul>		* Submit a USB flash drive with TransCAD tutorials of TC-UC Chapters 11-17 and TC-RL Chapters 1, 3, 5 by 2:30 PM today (April 13, 2023) * Lab assignment #3 handout
25 (4/18, T)	<ul style="list-style-type: none"> <li>▪ Transportation Planning and Travel Demand Analysis (Miller &amp; Shaw, Chap. 8)</li> </ul>		
26 (4/20, R)	<ul style="list-style-type: none"> <li>▪ Transportation Planning and Travel Demand Analysis (Miller &amp; Shaw, Chap. 8)</li> </ul>		* Lab assignment #3 due by 2:30 PM today (April 20, 2023)
27 (4/25, T)	<ul style="list-style-type: none"> <li>▪ Transportation Planning and Travel Demand Analysis</li> </ul>		

	(Miller & Shaw, Chap. 8)		
28 (4/27, R)	▪ Transportation Planning and Travel Demand Analysis (Miller & Shaw, Chap. 8)		
29 (5/2, T)	▪ Transportation Planning and Travel Demand Analysis (Miller & Shaw, Chap. 8)		
30 (5/4, R)	▪ Wrap up		
31 (5/9, T)	▪ Work on GIS-T project		
(May 11, Thursday, 10:00 AM – 12:15 PM, BGB 404)	▪ Final Project Presentations (Each student will give a 10-minute presentation and live demonstration of her/his class project.)		<p>* Each student must submit all TransCAD project data and other relevant files to the instructor (<a href="mailto:sshaw@utk.edu">sshaw@utk.edu</a>) by 10 AM on May 11, 2023 according to the instructions provided by the instructor.</p> <p>* Each student also must email a project report to the instructor (<a href="mailto:sshaw@utk.edu">sshaw@utk.edu</a>) by 10 AM on May 11, 2023.</p>

- \* This schedule is subject to change. Updated syllabus (if any) will be posted on the Canvas website of this course. Please contact the instructor if you have questions about course materials or course requirements.
- \* The instructor may switch some classes to meetings via Zoom when needed. In such cases, the instructor will make an announcement on the Canvas course website and email the students to inform them.
- \* TC-UC: TransCAD User's Guide is available under the "Help" menu option of TransCAD.
- \* TC-RL: TransCAD Routing and Logistics User's Guide is available under the "Help" menu option of TransCAD.

#### UTK Campus Syllabus:

Dear Student,

The purpose of this Campus Syllabus is to provide you with important information that is common across courses at UT. Please observe the following policies and familiarize yourself with the university resources listed below. At UT, we are committed to providing you with a high-quality learning experience. I want to wish you the best for a successful and productive semester.

- Dr. John Zomchick, Provost and Senior Vice Chancellor

#### UNIVERSITY CIVILITY STATEMENT -- <http://civility.utk.edu/>

"Civility is genuine respect and regard for others: politeness, consideration, tact, good manners, graciousness, cordiality, affability, amiability and courteousness. Civility enhances academic freedom and integrity and is a prerequisite to the free exchange of ideas and knowledge in the learning community. Our community consists of students, faculty, staff, alumni, and campus visitors. Community members affect each other's well-being and have a shared interest in creating and sustaining an environment where all community members and their points of view are valued

and respected. Affirming the value of each member of the university community, the campus asks that all its members adhere to the principles of civility and community adopted by the campus.”

### **EMERGENCY ALERT SYSTEM -- <http://safety.utk.edu/>**

The University of Tennessee is committed to providing a safe environment to learn and work. When you are alerted to an emergency, please take appropriate action. Learn more about what to do in an emergency and sign up for [UT Alerts](#). Check the emergency posters near exits and elevators for building specific information. In the event of an emergency, the course schedule and assignments may be subject to change. If changes to graded activities are required, reasonable adjustments will be made, and you will be responsible for meeting revised deadlines.

### **ACADEMIC INTEGRITY**

Each student is responsible for his/her personal integrity in academic life and for adhering to UT's Honor Statement. The Honor Statement reads: “An essential feature of the University of Tennessee, Knoxville is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student of the university, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity.”

### **YOUR ROLE IN IMPROVING THE COURSE THROUGH ASSESSMENT**

At UT, it is our collective responsibility to improve the state of teaching and learning. During the semester you may be requested to assess aspects of this course either during class or at the completion of the class. You are encouraged to respond to these various forms of assessment as a means of continuing to improve the quality of the UT learning experience.

### **STUDENTS WITH DISABILITIES -- <http://sds.utk.edu>**

“Any student who feels he or she may need an accommodation based on the impact of a disability should contact the Student Disability Services (SDS) at 865-974-6087 in 100 Dunford Hall to document their eligibility for services. Student Disability Services will work with students and faculty to coordinate reasonable accommodations for students with documented disabilities.”

### **ACCESSIBILITY POLICY AND TRAINING – <http://accessibility.utk.edu>**

### **WELLNESS -- <http://counselingcenter.utk.edu/> and <http://wellness.utk.edu/>**

**The Student Counseling Center** is the university's primary facility for personal counseling, psychotherapy, and psychological outreach and consultation services. **The Center for Health Education and Wellness** manages *974-HELP*, the distressed student protocol, case management, the *Sexual Assault Response Team*, and the *Threat Assessment Task Force*.

### **SOCIAL DISTANCING & COVID-19 PROCEDURES –**

Students are required to wear face masks at all times and maintain social distancing (6 feet between individuals in traditional classrooms, or, in instructional laboratories and similar settings, only a few minutes in closer proximity when absolutely necessary to achieve learning objectives). Students who are feeling ill or experiencing symptoms such as sneezing, coughing, or a higher than normal temperature will be excused from class and should stay at home.

Instructors have the right to ask those who are not complying with these requirements to leave class in the interest of everyone's health and safety. In the event that a student refuses to comply with these requirements, the instructor has the right to cancel class.

Additionally, following other simple practices will promote good health in and out of the classroom, such as frequent and thorough hand washing, wiping down desks and seats with disinfectant wipes whenever possible, not sharing personal items such as pens and cell phones, and avoiding crowded hallways and other enclosed spaces.

The Volunteer Creed reminds us that we bear the torch in order to give light to others. As Volunteers, we commit to caring for one another and for the members of the communities in which we live, work, and learn. This semester, the University asks that we all demonstrate the Volunteer spirit by following these and other health guidelines and requirements.