**UP 431: Urban Transportation Modeling**
Spring 2022, Department of Urban and Regional Planning, University of Illinois at Urbana-Champaign

**CLASS MEETINGS:** Friday, 9:00 – 11:40 am

**CREDIT HOURS:** 4 hours for graduate students; and 3 hours for undergraduate students

**INSTRUCTOR:** Bumsoo Lee, bumsoo@illinois.edu

**OFFICE HOURS:** 1:00 – 1:50 pm on Wednesday and by appointment, TBH M206

---

**COURSE OVERVIEW**

“All models are wrong; some are useful.” – George Box

This course provides the basic skills needed to understand how planners and decision makers can use information about travel behavior to plan transportation investments. Travel demand models often support these decisions and have an air of authority because they produce precise estimates of trip-making patterns. But how the models translate inputs to outputs is often opaque and relies on assumptions that may or may not mirror reality. While you will learn practical skills in travel demand modeling applications in this course, you will also learn to understand and critique these models using knowledge of travel behavior theory, methods, and problem-solving skills.

**Learning objectives**
By the end of the course, you will be able to:
- Apply behavioral theory and discrete choice analysis to understand travel behavior
- Describe transportation data sources and collection methods
- Explain how travel demand models work
- Critique transportation models and their outputs
- Analyze planning scenarios using travel demand modeling software

---

**COURSE AT A GLANCE**

<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Topic</th>
<th>Assignment Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jan 21</td>
<td>Introduction; Travel behavior fundamentals</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Jan 28</td>
<td>Transportation data collection &amp; analysis</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Feb 4</td>
<td>Review of statistics</td>
<td>Assignment 1</td>
</tr>
<tr>
<td>4</td>
<td>Feb 11</td>
<td>Discrete choice analysis</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Feb 18</td>
<td>Discrete choice analysis</td>
<td>Assignment 2</td>
</tr>
<tr>
<td>6</td>
<td>Feb 25</td>
<td>TDM and Modeling software; Guest lecture</td>
<td>Grad term paper study plan</td>
</tr>
<tr>
<td>7</td>
<td>Mar 4</td>
<td>Trip generation</td>
<td>Assignment 3</td>
</tr>
<tr>
<td>8</td>
<td>Mar 11</td>
<td>Trip generation &amp; distribution</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Mar 25</td>
<td>Trip distribution</td>
<td>Grad progress report</td>
</tr>
<tr>
<td>10</td>
<td>Apr 1</td>
<td>Mode choice</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Apr 8</td>
<td>Trip assignment</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Apr 15</td>
<td>Evaluating alternatives and related models</td>
<td>Assignment 4</td>
</tr>
<tr>
<td>13</td>
<td>Apr 22</td>
<td>Graduate student term paper presentations</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Apr 29</td>
<td>Final project presentations</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td>Final project report (May 9, Noon)</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td>Grad term paper (May 13, Noon)</td>
</tr>
</tbody>
</table>
**PREREQUISITE**

UP 430 or CEE 417, or consent of instructor. **Junior standing** required. Familiarity with basic statistics and R program will be required for the success in UP 431.

**EVALUATION**

<table>
<thead>
<tr>
<th></th>
<th>Undergraduate students</th>
<th>Graduate students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four homework assignments</td>
<td>60 %</td>
<td>40 %</td>
</tr>
<tr>
<td>Final (travel demand forecast) project</td>
<td>30 %</td>
<td>30 %</td>
</tr>
<tr>
<td>Term paper research</td>
<td>-</td>
<td>20 %</td>
</tr>
<tr>
<td>Participation and attendance</td>
<td>10 %</td>
<td>10 %</td>
</tr>
</tbody>
</table>

Graduate students are required to conduct an empirical study on travel behavior, using the NHTS or other travel survey data, in addition to common course requirements. Detailed guidelines will follow.

**RUBRIC:**

A: Demonstrates original thought and synthesis of ideas and cogent analysis, and is clearly written and presented. Outstanding work.

B: Presents above average analysis with appropriate evidence to support ideas, and is clearly written or presented. Good work.

C: Shows a basic level of understanding, with analysis limited to obvious arguments. Writing is competent. Adequate work.

D: Misunderstands or misrepresents the material, or is so poorly written or presented as to obscure the analysis. Inadequate work.

Transformation of numerical grade to letter grade will be according to the schedule below:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Numerical Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>97-100</td>
</tr>
<tr>
<td>A</td>
<td>93-96.9</td>
</tr>
<tr>
<td>A-</td>
<td>90-92.9</td>
</tr>
<tr>
<td>B+</td>
<td>87-89.9</td>
</tr>
<tr>
<td>B</td>
<td>83-86.9</td>
</tr>
<tr>
<td>B-</td>
<td>80-82.9</td>
</tr>
<tr>
<td>C+</td>
<td>77-79.9</td>
</tr>
<tr>
<td>C</td>
<td>73-76.9</td>
</tr>
<tr>
<td>C-</td>
<td>70-72.9</td>
</tr>
<tr>
<td>D+</td>
<td>67-69.9</td>
</tr>
<tr>
<td>D</td>
<td>60-66.9</td>
</tr>
</tbody>
</table>

**COURSE REQUIREMENTS**

**Homework Assignments (All Students):** Four homework assignments will be given throughout the semester. All homework assignments are due by **9pm** on due dates unless noted otherwise. Late submission of homework assignments will be penalized by 10% per day, up to 30%.

**Travel Demand Forecast Team Project (All Students):** Students will forecast and analyze future travel demand in the Champaign-Urbana region for the horizon year 2040 based on different alternate scenarios for the region. Students will work in a team of three students, will present their project outcomes in class, and will submit a final project report that describes the research process, the results of the model, and any issues found along the way. I suggest you build your team so that you have at least one graduate student member to lead the project team. Detailed guidelines will follow.

**Term Paper Research & Presentation (Graduate Students):** Graduate students are required to conduct and present term paper research, and submit a 12-page paper. The term paper must be an empirical study that investigates people’s travel behavior, using travel survey data. While students can choose a travel behavior topic
of their own interest, they are encouraged to apply a discrete choice model that they learned in class. Detailed guidelines on the term paper will follow.

Schedules for term paper deadlines:
[Mar 25] Three-page progress report documenting what have been done and what need to be done, expected findings, and expected content in the final paper.
[April 22] Term paper research presentations.

**POLICIES**

**SPECIAL ACCOMMODATIONS**
This course will accommodate students with documented disabilities. Please refer to [http://disability.illinois.edu/disability-resource-guide](http://disability.illinois.edu/disability-resource-guide) for more information and provide the appropriate documentation at the beginning of the semester.

**ACADEMIC INTEGRITY**
This course follows the guidelines set forth by the University student code. See [http://studentcode.illinois.edu/article1_part4_1-401.html](http://studentcode.illinois.edu/article1_part4_1-401.html) for specific guidelines, examples, and punishment associated with academic dishonesty.

**PLAGIARISM**
No student shall represent the words, work, or ideas of another as their own in any academic endeavor. Plagiarism includes but is not limited to copying, direct quotation, paraphrase, and borrowed facts or information. See the guidelines on the student code to avoid plagiarism [https://studentcode.illinois.edu/article1/part4/1-402/](https://studentcode.illinois.edu/article1/part4/1-402/).

**CLASS CLIMATE**
The Department of Urban and Regional Planning (DURP) is committed to creating an environment of inclusion and opportunity that is rooted in the very goals and responsibilities of practicing planners. Conduct that interferes with the rights of another or creates an atmosphere of intimidation or disrespect is inconsistent with the environment of learning and cooperation that the program requires. By enrolling a course in the Department of Urban and Regional Planning, students agree to be responsible for maintaining a respectful environment in all DURP activities, including lectures, discussions, labs, projects, and extracurricular programs. We will be governed by the University Student Code. See Student Code Article 1—Student Rights and Responsibilities, Part 1. Student Rights: §1-102 In the Classroom.

**EMERGENCY RESPONSE RECOMMENDATIONS**
The Department of Homeland Security and the University of Illinois at Urbana-Champaign Office of Campus Emergency Planning recommend the following three responses to any emergency on campus: **RUN > HIDE > FIGHT**
For more information, [http://police.illinois.edu/emergencyplanning/general/](http://police.illinois.edu/emergencyplanning/general/)

**COUNSELING CENTER**
The Counseling Center is committed to providing a range of services intended to help students develop improved coping skills in order to address emotional, interpersonal, and academic concerns. The Counseling Center provides individual, couples, and group counseling. All of these services are paid for through the health services fee. The Counseling Center offers primarily short term counseling, but they do also provide referrals to the community when students could benefit from longer term services. [https://counselingcenter.illinois.edu/](https://counselingcenter.illinois.edu/)
COURSE SCHEDULE

Notes:


**Week 1: Introduction to travel demand models and planning; travel behavior fundamentals**

Gen & Hanson (2017), Miller, Harvey. Ch 5 Theories and models in transportation planning, pp. 113-138.

Gen & Hanson (2017), Boarnet, Marlon. Ch 7 Land use, travel behavior, and disaggregate travel data, pp. 113-138.

**Week 2: Transportation data collection and analysis**


**Week 3: Review of statistics-Ordinary least square (OLS) regression**


**Weeks 4 & 5: Introduction to discrete choice analysis**


**Week 6: TDM and Introduction to modeling software**

Gen & Hanson (2017), Sciara, Gian-Claudia and Susan Handy. Ch 6 Regional transportation planning, pp. 113-138.
Weeks 7 & 8: Trip generation

NCHRP 716, Sections 4.3 and 4.4.


Weeks 8 & 9: Trip distribution

NCHRP 716, Sections 4.5 and 4.6.


Week 10: Mode choice

NCHRP 716, Section 4.7


Week 11: Trip assignment

NCHRP 716, Sections 4.8, 4.9, 4.11, and 4.12.


Week 12: Evaluating alternatives and related models


[Optional] NCHRP 716, Chapter 6. Emerging modeling practices


Week 13: Graduate student term paper presentations

Week 14: Final project presentations

Final project report due, Noon on May 9th

Graduate student term paper due, Noon on May 13th