The Group offers MS and PhD degrees in Transportation Technology & Policy. Students have the option of following either a technology or policy/management track. Core courses are required of all students, with variations by degree and track.

The Master’s degree is either a Plan I (thesis) or Plan II (examination) program designed to take one to two years. The normative time for a PhD degree is expected to be 4 years after a BS, and 2-3 years after an MS. There is no direct-to-PhD option, bypassing the MS.

The curriculum for the Group includes courses in the following three areas (see table and lists at end):

- Core courses required of all MS and PhD students;
- Policy/planning courses in economics, statistics, planning, policy analysis, and management;
- Technology courses in mechanical engineering, chemical engineering, civil and environmental engineering, and related fields.

Master’s degrees require a minimum of 36 quarter units and PhD degrees require a minimum of 54 units, in addition to any prerequisites that have not previously been taken. Prerequisites required of all students entering the program (may be fulfilled after enrollment at UCD, but as soon as possible) are: two courses in calculus, one in linear algebra, and one each in calculus-level microeconomics and probability/statistics.

MS Plan I students take between 15-20 units from a common set of core courses; 8 units from courses in the chosen track; 2 units from courses in the other track; and up to 6 units for Thesis/TTP 299 research group study. At least 12 units of coursework must be at the graduate level. MS Plan II students take between 15-20 units from a common set of core courses; 12 units from courses in the chosen track; and 4 units from courses in the other track. At least 18 units of coursework must be at the graduate level. PhD students must complete 24-32 units from the same core; 21 units from the chosen track; 9 units from the other track; and a dissertation. At least 2/3 of all units must be taken at the graduate level and 2/3 of all units must be taken for a letter grade. Up to 27 units taken at another accredited university as part of a related master’s degree may be counted toward the PhD, with permission of the Graduate Adviser.

The Master’s examination will be taken at the completion of the required 36 units of coursework. Possible outcomes are pass/no pass/fail. With a “no pass” outcome, the exam may be taken again at a later date, with only pass and fail outcomes possible the second time.

Students without an MS who want to continue for a PhD are initially admitted for the MS, and must petition to change their degree objective before being admitted to the PhD program. This petition will normally not be entertained before the student has completed at least ½ of the coursework units required for the MS. Approval of the Graduate Adviser for the change of degree objective will be given without further consultation with TTP faculty if four of the following five criteria are satisfied:

1. Undergraduate GPA > 3.2
2. Graduate GPA > 3.5
3. Quantitative GRE score in the 90th percentile or higher
4. Strong letter of recommendation from student’s Faculty Advisor
5. Strong letter of recommendation from the faculty member in TTP likely to be advising the student in doctoral work.

PhD students must take an oral qualifying examination at the beginning of their dissertation research. The candidate will be examined on areas of study that are important to transportation technology and policy and/or that are relevant to the proposed dissertation research. The examination will be conducted by a committee of five faculty members, which must be approved by the Graduate Advisor and appointed by the Dean of Graduate Studies. The committee may include the major professor (but not be chaired by her/him) and may also include other members of the candidate’s expected dissertation committee. The committee will normally include three or four people representing the chosen track, and one or two people representing the other track. At least 3 members must be voting members of TTP. This examination will also be scored pass/no pass/fail on the first attempt, and pass/fail on the second.

Candidates for the PhD degree will write a doctoral dissertation after completion of the coursework. The dissertation research project will be overseen by a Dissertation Committee chaired by a major professor who will normally be a member of TTP. The dissertation will address a subject chosen by the student and contain the following elements:

- It must be original;
- It must demonstrate creative and independent work and be of publishable quality for a peer-reviewed journal;
- It must contribute to the body of knowledge in transportation technology or policy;
- All aspects must be defensible, including hypothesis(es), quality of data, methods, results and interpretation;
- The work must be primarily that of the student; the student should be primary author of all chapters or manuscripts included in the dissertation;
- The dissertation must be tied together by a unifying theme.

A monograph format may be used if deemed appropriate by the student’s Dissertation Committee; however, a rule of thumb is that the dissertation should contain sufficient appropriate material for at least three peer-reviewed journal articles. It is recommended that at least one manuscript derived from the dissertation be submitted (not necessarily accepted) for publication in a peer-reviewed journal before the dissertation is approved. Instructions on the dissertation format are available from Graduate Studies. Students will be encouraged to present a seminar when they are nearing completion of their dissertation.

The candidate must file with the Dean of Graduate Studies one copy of the dissertation approved by the Dissertation Committee, not later than three weeks before the close of the quarter in which the degree is to be conferred. An abstract of the dissertation must be filed by the same date.

At the time of filing the dissertation, the student is encouraged to sign an agreement with University Microfilms, Inc. to microfilm the dissertation and print the abstract in Dissertation Abstracts. Arrangements for copyrighting the dissertation and for obtaining reprints of the abstract, if desired, must also be made at this time. Dissertations will be withheld from microfilming only at the request of the student and then for a period not in excess of three years from the date the dissertation is filed. Complete information is available from Graduate Studies.
### TTP Program Core Courses

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<tr>
<th>Research Methods</th>
<th>Transportation Modeling/Analysis</th>
<th>Policy Analysis</th>
<th>Economics</th>
<th>Technology</th>
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<td><strong>MS Students: select one</strong></td>
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<tr>
<td><strong>ESP 278: Research Meth. in Env. Policy</strong></td>
<td>ECI 251: Trans. Demand Analysis</td>
<td>ESP 212 A: Env. Policy Process</td>
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<td><em>MGT 249 Marketing Research</em>*</td>
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<td>ESP 212 B: Env. Policy Evaluation</td>
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<td>ECI 262: Transit System Analysis</td>
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<td>POL 208: Policy Analysis</td>
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<td><strong>MS: 1 class (choose from top section)</strong></td>
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<td><strong>Ph.D. 2 classes (one from top section and one from classes listed below, dependent on emphasis)</strong></td>
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<td><strong>2 classes (policy students)</strong></td>
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<td><strong>Policy Ph.D.: also select one:</strong></td>
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<td>ECI 254: Discrete Choice Analysis</td>
<td>ARE 252: Non-Linear Programming</td>
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<td><strong>Tech. Ph.D.: also select one:</strong></td>
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<td>EBS 265: Design &amp; Analysis of Engineering Experiments</td>
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</table>

* Due to the substantial overlap between MGT 249 and TTP 200, students taking both courses will receive a total of 5 units of credit toward the degree.

** Due to the substantial overlap in content between TTP 200 and ESP 278, beginning Fall 2002 only 6 units of credit will count toward the degree for students taking both.
A distinguishing characteristic of modern planning, policy analysis, and management is the ability to apply statistical techniques and economic analysis to decisionmaking. Courses in economics and statistics will provide the student with the knowledge and tools essential to planning and analyzing solutions to problems plaguing transportation – a cluster of complex sociotechnical systems. Accordingly, coursework in these areas is a fundamental component of this program.

Building upon the fundamentals of micro-economics and statistics are additional courses that provide more skills and address transportation in a substantive manner; they include courses in resource, environmental, and land use law; environmental economics; organizational behavior; survey research; travel and purchase behavior; and policy formulation, implementation, and evaluation.

Approved courses in this area include the following (other courses may be added upon approval by the Chair):

**Note: Courses normally appear only under one category even though they may overlap multiple categories.**

**Transportation/Environment Planning/Policy**

- ECI 165 Transportation Policy
- ECI 262 Transit Systems Analysis
- ECI 258 Transportation Planning in Developing Countries
- ECI/ESP 163 Energy and Environmental Aspects of Transportation
- ECL 213 Population, Environment, and Social Structure
- ESP 167 Energy Policy
- ESP 168A Methods of Environmental Policy Evaluation
- ESP 168B Methods of Environmental Policy Analysis
- ESP 171 Environmental Planning
- ESP 179 Environmental Impact Reporting
- ESP 212A Environmental Policy Process
- ESP 212B Environmental Policy Analysis: Evaluation
- POL 107 Environmental Politics and Administration

**Land Use/Urban Planning**

- CRD 171 Housing and Social Policy
- CRD 240 Human and Community Development-Community Development History
- CRD 245 Political Economy of Urban and Regional Development
- ENH 110 Urban and Regional Planning
- ESP 173 Public Mechanisms for Controlling Land Use
- GEO 155 Urban Geography
- GEO 156 The Urban Region
- LDA 201 Landscape Architecture-Theory and Philosophy of the Designed Environment
- MGT 232 Urban Planning and Policy
Economics

ARE 100B Intermediate Microeconomics: Imperfect Competition, Markets, and Welfare
ARE/ESP 175 Natural Resource Economics
ARE 176 Environmental Economics
ARE 275 Economic Analysis of Resource and Environmental Policies
ECI 268 Public Works Economics
ECN 145 Transportation Economics

Marketing/Management

ARE 136 Managerial Marketing
MGT 240 Management Policy and Strategy
MGT 249 Marketing Research
MGT 250 Technology Management
MGT 251 Management of Innovation
MGT 252 Production and Operations Management

Research Methods

ESP 278 Research Methods in Environmental Policy
MGT 249 Marketing Research
TTP 200 Transportation Survey Methods

Statistics/Quantitative Methods

AGR 205 Experimental Design and Analysis
AGR 206 Multivariate Systems and Modeling
ARE 106 Quantitative Methods in Agricultural Economics
ECI 254 Discrete Choice Analysis of Travel Demand
ECN 140 Econometrics
ECN 240A Econometric Methods (regression)
ECN 240B Econometric Methods (simultaneous equations)
ECN 256 Applied Econometrics
MGT 285 Time Series Analysis and Forecasting
PSY 207A Causal Modeling of Correlational Data
PSY 207B Applied Multivariate Analysis of Psychological Data
STA 106 Analysis of Variance
STA 108 Regression Analysis
STA 110 Multivariate Analysis
STA 103A,B Mathematical Statistics: Brief Course
STA 131A Introduction to Probability Theory
STA 131B,C Mathematical Statistics
STA 135 Multivariate Data Analysis
STA 137 Applied Time Series Analysis
STA 138 Analysis of Categorical Data
STA 140 Introduction to Biostatistics
STA 142 Reliability
STA 144 Sampling Theory of Surveys
STA 205  Statistical Methods for Research
STA 222  Biostatistics: Survival Analysis
STA 223  Biostatistics: Linear Models

**Operations Research**

ARE 252  Applied Linear Programming
ARE 253  Optimization Techniques with Economic Applications
ARE 254  Dynamic Optimization Techniques with Economic Applications
ARE 255  Advanced Topics in Economic Dynamics
ECI 153  Deterministic Optimization and Design

**Mathematics**

MAT 108  Introduction to Abstract Mathematics
MAT 227  Scientific Computation Applied to Problems in Biology
MAT 258A,B  Numerical Optimization I, II

**Other**

NUT 492A  Professionalism
TTP 292  Internship in Transportation Technology and Policy
TTP 298  ITS-Davis Seminar Series

**APPROVED COURSES – TECHNOLOGY TRACK**

All students will be required to gain knowledge of one or more transportation-related technologies, including electric-drive propulsion technologies, emissions and energy use of internal combustion engines, “intelligent transportation system” technologies, remote sensing and data collection, and mapping and visualization. Approved courses in this area are listed below. Many of the listed courses are at the undergraduate level because these are the more general “technology” courses. Students may petition the Group Chair to add other courses to the approved list.

Note: Courses normally appear only under one category even though they may overlap multiple categories.

**Air Quality/Emissions**

ATM 116  Climate Change
ATM 270  Air Pollution Instrumentation
ECI 149  Introduction to Air Pollution
ECI 242  Air Quality
ECI 269  Transportation-Air Quality: Theory and Practice
EME 161  Combustion and the Environment
ERS 131  Air as a Resource
GIS/Remote Sensing

ABT 181  Geographic Information Systems Modeling (ArcView)
AMR 132  Geographic Information Systems in Applied Ecology
AMR 198  Directed Group Study for AMR 132
ERS 186  Environmental Remote Sensing

Quantitative Methods

EAD 115  Introduction to Numerical Methods for Engineers and Scientists
EAD 116  Computer Solution of Physical Problems
EAL 220A,B  Artificial Neural Nets
EBS 265  Design and Analysis of Engineering Experiments
ECS 168  Information Systems
EEC 207  Pattern Recognition and Classification

Transportation Systems

ECI 161  Transportation Systems Engineering
ECI 162  Transportation System Design
ECI 257  Flows in Transportation Networks

Vehicle Design

ECI 189  Engineering of Alternate Fueled Vehicles and Emissions Control
EME 134  Vehicle Stability
EME 163  Internal Combustion Engines
EME 188  Vehicle Systems Design Project
MAE 217  Combustion
MAE 226  Acoustics and Noise Control
MAE 234  Design and Dynamics of Road Vehicles
MAE 236  Aerodynamics in Nature and Technology

Other

TTP 292  Internship in Transportation Technology and Policy
TTP 298  ITS-Davis Seminar Series