

April 15, 2019

SUSAN HANDY, PROGRAM CHAIR
Transportation Technology and Policy

RE: Transportation Technology and Policy Degree Requirements

Enclosed is a copy of the Transportation Technology and Policy graduate degree requirements as approved by Graduate Council on April 5, 2019. These degree requirements are now the official requirements for the Transportation Technology and Policy Graduate Group and will be posted on the Office of Graduate Studies program webpage:

<https://grad.ucdavis.edu/programs/gttp>

Thank you for your efforts on behalf of graduate education.

Sincerely,

A handwritten signature in black ink, appearing to read "C. Arnett". The signature is fluid and cursive, with a large initial "C" and a stylized "A".

Carlee Arnett, Chair
Graduate Council

CC: Amanda Kimball, Graduate Studies Analyst
Annemarie Schaaf, Graduate Program Coordinator
Felicia Murdoch, Educational Policy Committee Analyst

**GRADUATE GROUP in
TRANSPORTATION TECHNOLOGY AND POLICY
Ph.D. AND MS DEGREE REQUIREMENTS**

Revised: 2003, 2014, 2015, 2018, 2019

Current revision: approved by vote of TTP faculty, October 2014 and June 2015

Revised for resubmission to Graduate Council March 2019

Graduate Council Approval: April 5, 2019

Master's Degree Requirements

1) Admissions requirements:

Consideration for admission to graduate studies requires a bachelor's degree from an accredited institution, three letters of recommendation, official transcripts, scores on the General Test of the Graduate Record Examinations (GRE), TOEFL or IELTS score (if applicable), prerequisite course completion listing (see item a) below) and an Office of Graduate Studies online application with fee by the stated admission deadline. The decision whether to recommend admission to the Dean of Graduate Studies will be made by the Program Admissions Committee consisting of the Graduate Advisers and final review by the Chair of the graduate group on the basis of available space, and the competitiveness of applicants compared to the eligible pool. Students are generally admitted for the fall quarter, but exceptional cases for off-cycle admission can be considered.

- Master's degree applicants must have earned a grade point average of at least 3.0 in the junior and senior years of college.
- International students are expected to achieve a minimum score of 550 on the paper-based or 80 on the iBT Test of English as a Foreign Language (TOEFL), or an overall BAND score of 7 or more (on a 9-point scale) on the IELTS exam. TOEFL and IELTS scores expire after two years.

a) Prerequisites:

In addition to the admission requirements stated above, applicants must have passed the equivalent of the following UC Davis courses:

- [MAT 16A](#), MAT 17A or [MAT 21A](#) Calculus (1) 3-4 units
- [MAT 16B](#), MAT 17B or [MAT 21B](#) Calculus (2) 3-4 units
- [ECI 114](#), [STA 100](#), STA 103 Probability/Statistics (with calculus) 4 units
- [ECN 100A](#) or [ARE 100A](#) Microeconomics (preferably with calculus) 4 units

Questions regarding equivalent courses already taken should be addressed to the Graduate Coordinator and will be determined by the Program Admissions Committee.

b) Deficiencies:

Calculus 1 and 2, Probability/Statistics (with calculus) and Microeconomics (preferably with calculus) must be completed before entering the program or within the first academic year afterward. An extension of this requirement may be requested from the Graduate Adviser if all the prerequisites cannot be taken within the first year. ***Courses taken to meet the prerequisites will not count toward the TTP degree.*** These prerequisites may be taken on a pass/fail basis or in other ways but we caution students that a firm grasp of these subjects (at the level of an A or B letter grade) is important as

a foundation for courses to be taken in this program. The applicant must complete the form documenting the fulfillment of these requirements at the time application is made to the TTP program. If the requirements have not been completed at the time of application, the form must be updated upon completion of all requirements, with a final deadline of the end of the first academic year. If all requirements are not completed by the end of the first academic year after enrollment, the group will recommend the student be disqualified from the program by the Dean of Graduate Studies, unless an exception is granted by the graduate group.

c) Major Professor

Graduate students will be assigned a Major Professor in the first quarter of enrollment. The Major Professor is charged with reviewing the academic progress of the student and advising the student regarding academic choices and decisions.

2) M.S. Plan I (Thesis), II (Comprehensive Examination)

Plan I Requirements: The student must complete 36 units of coursework at the upper division and graduate levels, including the core requirements, and submission of a satisfactory thesis. Up to 6 units of Thesis/TTP 299 Research Group Study can count as part of the 36. At least 24 of the 36 units must be at the graduate level. The student may choose electives from additional core courses beyond those required in each category (track) area (i.e. Policy, Technology, Systems, see table in section 3.a. below) and from the approved list of elective courses for the TTP program, with no restrictions on category (track).

The MS Plan I Thesis Committee ensures that the quality of the thesis is appropriate for the degree. The topic should be acceptable to all three members of the committee, when they agree to serve. Expectations on length and level of scholarship appropriate to master's theses vary across faculty, and the student should ascertain these expectations from the committee members at the time they agree to serve. For the thesis to be acceptable for degree conferral, all members must sign the title page certifying that the student has completed the thesis to their satisfaction.

This Plan requires more units than the UC Davis minimum, which are: 30 units of graduate and upper division courses (the 100 and 200 series only), at least 12 of which must be graduate work in the major field.

Plan II Requirements: The student must complete 36 units of coursework at the upper division and graduate levels, including the core requirements, and satisfactory performance on a 2 hour comprehensive oral examination. No TTP 299 Research Group Study can count as part of the 36. At least 24 of the 36 units must be at the graduate level. The student may choose electives from additional track or skills areas beyond those required in each category and from the approved list of elective courses for the TTP program, with no restrictions on category.

The comprehensive examination committee examines the student on their transportation and related knowledge, including coverage of core courses and other courses in the student's Program of Study.

This Plan requires more units than the UC Davis minimum, which are:
 36 units of graduate and upper division courses, of which at least 18 units must be graduate courses in the major field. Not more than 9 units of research (299 or equivalent) may be used to satisfy the 18-unit requirement.

3) Course Requirements – Core, Tracks, Skill Areas and Electives (36 units)

a) Summary

The TTP MS degree requires 24-28 units of core, track, and skill area coursework, up to 6 units of TTP 299 (for Plan I students only), and elective courses to sum to 36 units in all. At least 24 units must be at the graduate level, which can include TTP 299 (for Plan I students only). In addition, six quarters of TTP 281 are required but do not count in the units total (see notes below). Full-time students must enroll for a minimum of 12 units per quarter including research, academic and seminar units. Courses that fulfill any of the program course requirements may not be taken S/U unless the course is normally graded S/U. Once course requirements are completed, students can take additional classes as needed, although the 12 units per quarter are generally fulfilled with a research class (299) and perhaps seminars. Per UC regulations, students cannot enroll in more than 12 units of graduate level courses (200) or more than 16 units of combined undergraduate and graduate level (100, 200, 300) courses per quarter.

b) Core Courses (12 units)

CORE CLASSES		
TTP 210 (4 units) Transportation Technology	TTP 220 (4 units) Transportation Policy	ECI 254 (4 units) Data Science ¹
TTP 281 ITS-Davis Seminar: 2 years (6 quarters) ²		

¹Students with prior experience with data science may substitute an additional course from one of the track or skill areas (see below) for this course, with permission of the graduate advisor.

²Students are required to enroll in the weekly ITS Seminar (TTP 281, 1 unit) each quarter during the first two years of their program. The requirement to enroll in any given quarter can be postponed by petition to the Graduate Adviser, for academic reasons such as conflicting course schedules or recurring research obligations. Postponed enrollments are expected to be made up in the future, unless of course the terminal degree is completed first. These units do not count toward the 36 required to complete the MS.

c) Track (at least 6 to 8 units from one track)

TRACK		
MS – at least 2 courses from one track		
Vehicles and Fuels	Demand and Behavior	Infrastructure and Operations
<p>The transportation-energy nexus, and enabling and transformative technologies</p>	<p>Societal needs for mobility and strategies for meeting those needs</p>	<p>Challenges in designing, operating, and maintaining the transportation system</p>
<ul style="list-style-type: none"> ▪ TTP 289A Transportation Energy Modeling (4 units) ▪ EGG 202/ECN 216 Energy & Climate Policy (4 units) ▪ MAE 258 Hybrid Electric Vehicle System Theory and Design (4 units) ▪ MAE 269 Fuel Cell Systems (4 units) ▪ MAE 234 Design and Dynamics of Road Vehicles (4 units) ▪ EBS 216 Energy Systems (4 units) ▪ MAE 218 Advanced Energy Systems (4 units) ▪ EMS 170 Sustainable Energy Technologies (4 units) ▪ EBS 120 Power Systems Design (4 units) ▪ EME 163 Internal Combustion Engines and Future Alternatives (4 units) 	<ul style="list-style-type: none"> ▪ TTP 289A Behavioral Theories Seminar (1-5 units) ▪ ECI 251 Transportation Demand Analysis (4 units) ▪ ECI 289H Sustainable Freight Transportation (1-5 units) ▪ LDA 205 Urban Planning and Design (4 units) ▪ ESP 171 Urban and Regional Planning (4 units) ▪ MGT 249 Marketing Research (3 units) ▪ TTP 289A Discrete Choice Modeling (4 units) 	<ul style="list-style-type: none"> ▪ ECI 251 Transportation Demand Analysis (4 units) ▪ ECI 256 Urban Traffic Management and Control (4 units) ▪ ECI 257 Flow in Transportation Networks (4 units) ▪ ECI 268 Infrastructure Economics (3 units) ▪ TTP 289A Pavements for Managers and Policymakers (1-5 units) ▪ TTP 289A Bicycle and Pedestrian Planning (1-5 units)

d) Skill Areas (at least 6 to 8 units from one or more areas)

SKILL AREAS MS – at least 2 courses						
Economics	Data Analysis	Mathematical Modeling	Technology/ Infrastructure Assessment	Policy Analysis	Social Science Research	Experimental Design
Economic theory and econometric modeling	Statistical modeling and data analysis techniques	Mathematical modeling including linear/nonlinear programming and stochastic models	Tools and techniques for assessing impacts of technology and infrastructure	Theory and techniques for assessing policy	Methods for social science research	Design and analysis of experiments
ARE 175/ESP175 (4 units) ARE 176 (4 units) ARE 204A (4 units) ARE 256A (4 units) ARE 275 (4 units) ECN 125 (4 units) ECN 145 (4 units)	STA 106 (4 units) STA 108 (4 units) STA 138 (4 units) STA 141A (4 units) STA 141B (4 units) STA 141C (4 units) STA 206 (4 units) STA 208 (4 units) PLS 206 (4 units) GEO 200CN (4 units) TTP 289A Data Analysis (4 units)	ECI 249 (4 units) ECI 253 (4 units) ARE 252 (4 units) ARE 254 (4units) PHY 204A (4 units) MAT 258 A/B (4 units)	ECI 244A (4 units) ECI 269 (4 units) EBS 216 (4 units) ESP 179 (4 units) ABT/LDA 150 (4 units)	ESP 212A (4 units) ESP 212B (4 units) ARE 275 (4 units) POL 207 (4 units) POL 208 (4 units)	TTP 289A Survey Workshop (1-5 units) PSC 207 (4 units) ESP 278 (3 units) CMN 211 (4 units) ANT 206 (5 units) POL 210 (4 units)	MAE 207 (4 units) EBS 265 (5 units) PLS 205 (5 units)

e) Elective Courses (12 or more units)

Students are encouraged to choose additional courses beyond the minimum required from the track and skill areas as listed above but they may choose elective courses from the following list. Although a number of approved courses are undergraduate level, be aware of the restrictions on the minimum number of units (24) that must be taken at the graduate level.

Transportation/Environment Planning/Policy

TTP 282 Transportation Orientation Seminar (1 unit)

ECI 165 Transportation Policy (3 units)

ECI/ESP 163 Energy and Environmental Aspects of Transportation (4 units)

ECI 258 Transportation Planning in Developing Countries (3 units)

ECI 269 Transportation-Air Quality: Theory and Practice (4 units)

ECL 213 Population, Environment, and Social Structure (4 units)

ESP 167 Energy Policy (4 units)

TTP 289A Energy Journal Review (1 unit)

Policy Process

POL 175 Science, Technology and Policy (4 units)

POL 187 Administrative Theory (4 units)

POL 208 Policy Analysis (4 units)

ESP 168A Methods of Environmental Policy Evaluation (5 units)

Land Use/Urban Planning

ARE 144 Real Estate Economics (3 units)

CRD 171 Housing and Social Policy (4 units)

CRD 240 Community Development Theory (4 units)

CRD 245 Political Economy of Urban and Regional Development (4 units)

LDA 180G Special Topics in Landscape Architecture: Landscape & Regional Land Planning (2 units)

LDA 180L Special Topics in Landscape Architecture: Public Open Space (2 units)

LDA 180M Special Topics in Landscape Architecture: Urban and Community Design (2 units)

LDA 181M Urban and Community Design: Design and Planning Studio (2 units)

LDA 201 Theory and Philosophy of the Designed Environment (4 units)

Economics

ARE 100B Intermediate Microeconomics: Imperfect Competition, Markets, and Welfare (4 units)

ARE 130 Agricultural Markets (4 units)

ARE 176 Environmental Economics (4 units)

ARE 276 Environmental Economics (4 units)

ECI 268 Infrastructure (Public Works) Economics (3 units)

ECN 101 Intermediate Macro Theory (4 units)

ECN 200D Macroeconomic Theory (5 units)

Marketing/Management

ARE 136 Managerial Marketing (4 units)

ENG 250 Technology Management (3 units)

*MGT 240 Management Policy and Strategy (3 units)

*MGT 251 Management of Innovation (3 units)

*MGT 293 Topics in Marketing (3 units)

**Courses offered through the Graduate School of Management have very limited enrollment and are open to non-MBA students on a space-available basis.*

Behavioral Sciences

ANT 104N Cultural Politics of the Environment (4 units) ANT

127 Urban Anthropology (4 units)

ANT 211 Advanced Topics in Cultural Ecology (4 units)

ANT 222 Cities and Citizenship (4 units)

CMN 170 Communication, Technology, and Society (4 units)

CRD 162 People, Work and Technology (4 units)

HIS 172 American Environmental History (4 units)

POL 279 Political Networks: Methods and Applications (4 units)

PSC 155 Environmental Awareness (4 units)

SOC 141 Industrialization and Social Change (4 units)

SOC 143A Urban Society (4 units)

SOC 143B Sociology of City Life (4 units)

SOC 160 Sociology of the Environment (4 units)

Air Quality/Emissions

ATM 116 Climate Change (4 units)

ECI 149 Air Pollution (4 units)

ECI 242 Air Quality (4 units)

ECI 269 Transportation-Air Quality: Theory and Practice (4 units)

EME 161 Combustion and the Environment (4 units)

ESM 131 Air as a Resource (3 units)

GIS/Remote Sensing

ABT 180 Introduction to Geographic Information Systems (4 units)

ABT 181N Concepts and Methods in Geographic Information Systems (4 units)

ABT 182 Environmental Analysis using GIS (4 units)

ESM 186 Environmental Remote Sensing (3 units)

Quantitative Methods

EAD 116 Computer Solution of Physical Problems (4 units)

ECS 171 Machine Learning (4 units)

Transportation and Infrastructure Systems

ECI 143 Green Engineering Design and Sustainability (4 units)

ECI 161 Transportation Systems Engineering (4 units)

ECI 162 Transportation Land Use Sustainable Design (4 units)

ECI 179 Pavement Engineering (4 units)

ECI 250 Civil Infrastructure System Optimization and Identification (4 units)

ECI 253 Dynamic Programming and Multistage Decision Processes (4 units)
ECI 282 Pavement Design and Rehabilitation (4 units)
TTP 289A Energy Journal Review (1 unit)

Vehicle Design

EME 134 Vehicle Stability (4 units)
EME 161 Combustion and the Environment (4 units)
EME 163 Internal Combustion Engines and Future Alternatives (4 units)
MAE 216 Advanced Thermodynamics (4 units)
MAE 217 Combustion (4 units)
MAE 218 Advanced Energy Systems (4 units)
MAE 226 Acoustics and Noise Control (4 units)
MAE 234 Design and Dynamics of Road Vehicles (4 units)
MAE 236 Aerodynamics in Nature and Technology (4 units)
MAE 258 Hybrid Electric Vehicle Theory and Design (4 units)
MAE 269 Fuel Cell Systems (4 units)

Statistics/Quantitative Methods

PLS 205 Experimental Design and Analysis (5 units)
ARE 106 Quantitative Methods in Agricultural Economics (4 units)
EAD 115 Numerical Solution of Engineering and Scientific Problems (4 units) ECN
140 Econometrics (4 units)
ARE/ECN 240A Econometric Methods (4 units)
ARE/ECN 240B Econometric Methods (4 units)
ARE/ECN 240C Time Series Econometrics (4 units)
PSC 204A Statistical Analysis of Psychological Experiments (4 units)
PSC 204B Causal Modeling of Correlational Data (4 units)
PSC 204C Applied Psychometrics and Measurement Theory (4 units)
PSC 204D Advanced Statistical Inference from Psychological Experiments (4 units)
PSC 205A Applied Multivariate Analysis of Psychological Data (4 units)
PSC 205B Factor Analysis (4 units)
PSC 205C Structural Equation Modeling (4 units)
STA 130 Mathematical Statistics: Brief Course (4 units)
STA 131A Introduction to Probability Theory (4 units)
STA 131B,C Mathematical Statistics (4 units)
STA 135 Multivariate Data Analysis (4 units)
STA 137 Applied Time Series Analysis (4 units)
STA 138 Analysis of Categorical Data (4 units)
STA 142 Reliability (4 units)
STA 144 Sampling Theory of Surveys (4 units)
STA 205 Statistical Methods for Research with SAS (4 units)
STA 222 Biostatistics: Survival Analysis (4 units)
STA 223 Biostatistics: Generalized Linear Models (4 units)

Qualitative Methods

ANT 138 Ethnographic Research Methods in Anthropology (4 units)
CRD 151 Community Field Research: Theory and Analysis (4 units)

Operations Research

- ARE 155 Quantitative Analysis for Business Decisions (4 units)
- ARE 253 Optimization Techniques with Economic Applications (4 units)
- ARE 255 Advanced Topics in Economic Dynamics (3 units)
- ECI 153 Deterministic Optimization and Design (4 units)

Mathematics

- MAT 108 Introduction to Abstract Mathematics (4 units)
- MAT 227 Mathematical Biology (4 units)
- MAT 258A Numerical Optimization (4 units)

Other

- *MGT 290 Fundamentals of Energy Efficiency (3 units)
- TTP 292 Internship in Transportation Technology and Policy (units vary)
- TTP 396 Teaching Assistant Training Practicum (units vary)
- *Courses offered through the Graduate School of Management have very limited enrollment and are open to non-MBA students on a space-available basis.*

4) Special requirements: N/A.

5) Committees:

a) **Admission Committee:**

Once the completed application, all supporting material, and the application fee have been received, the application will be reviewed through the online application system by the Program Admissions Committee consisting of the Graduate Advisers. Recommendations for admission will be submitted by faculty to the Graduate Advisor with Admission Authority and reviewed by the Admissions Committee. After review, recommendations for admission will be forwarded to the Dean of Graduate Studies for final approval of admission. Notification of admissions decisions will be sent by Graduate Studies.

There are three different deadlines for applications. The dates will be published each year at the beginning of the admission cycle:

- **Priority for consideration of financial support:** Applicants who submit their graduate application by the Priority Deadline will receive priority review for admission.
- **General:** Applicants who submit their graduate application by the General Deadline (but after the Priority deadline) will be formally reviewed for admission by the graduate program but not on a priority basis.
- **Space Available:** Applicants who submit their graduate application by the Space Available Deadline (but after the General Deadline) are not guaranteed to have their application reviewed by the graduate program. Their application will be reviewed only if the graduate program determines that they have additional space available after reviewing Priority and General Deadline applicants.

Admissions for other than Fall quarter may be accepted for extraordinary circumstances and depending upon space.

b) Course Guidance or Advising Committee

All students require a three-person guidance committee which approves their Program of Study, and is responsible for monitoring their progress in the program. Members of this committee are proposed by the student and must be agreed-to by the student's Major Professor (or conversely), and approved by the TTP Graduate Adviser. Non-voting members of TTP can serve on guidance committees without special approval, but at least two members of the guidance committee, normally including the chair, must be Academic Senate members or Academic Federation members of TTP who have instructional appointments. The chair must be a member of the TTP graduate group, and normally at least one other committee member will also be.

A student should consult with his/her Major Professor to select a guidance committee as soon as possible, but no later than the end of their second quarter of study. The guidance committee is responsible for providing advice in formulating the "Program of Study". In consultation with his/her guidance committee, a student should develop a "Program of Study" no later than the second quarter of study. All "Programs of Study" must be approved by the Graduate Adviser, but it is understood that they are subject to change as individual's studies evolve.

c) Thesis Committee or Comprehensive Examination Committee

MS Plan I students will require a three-person thesis committee that advises the student on the thesis research and signs the thesis when it is satisfactorily completed.

MS Plan II students will require a three-person examination committee that administers the comprehensive exam and determines whether the student passes and receives the degree.

The three-person examination committee should be qualified to examine the student on transportation technology, transportation policy, the student's chosen track, and the student's chosen skill area(s). When asking for the Graduate Adviser's approval of the committee composition, students should clearly indicate what areas each member of the committee will be planning to cover on the exam. The [Comprehensive Exam Committee Request](#) form needs to be completed and returned to the Graduate Coordinator at least three weeks prior to the exam.

For both Plan I and Plan II committees, members of this committee are proposed by the student and must be approved by the student's Major Professor (or conversely) and approved by the Graduate Adviser. The program will help facilitate participation in committees by faculty, as necessary. The thesis committee (but not the exam committee) must also be approved by Graduate Studies. The Major Professor is normally the chair of the thesis committee. The Major Professor normally serves on but does not chair the examination committee. The student selects the exam Chair with help by the program if needed. The Chair of either committee must be a member of the TTP Graduate Group. Academic Senate members of TTP, or Academic Federation members of TTP who have instructional appointments, are automatically eligible to serve on any of these committees. Non-voting members of TTP can serve on thesis/dissertation committees following the Policy on Service on Advanced Degree Committees.

6) Advising Structure and Mentoring:

The **Major Professor** is the faculty member who supervises the student's research and thesis; this person serves as the Chair of the Thesis Committee. The **Graduate Adviser**, who is appointed by Graduate Studies, is a resource for information on academic requirements, policies and procedures, and registration information until the Course Guidance Committee is formed. The **Graduate Program Staff** assists students with identifying a Major Professor, identifying appointments, and general university policies.

The **Mentoring Guidelines** can be found at <http://gradstudies.ucdavis.edu/gradcouncil/mentoring.pdf>, and are linked to the TTP graduate student handbook (http://www.its.ucdavis.edu/?page_id=376, General Policies section).

7) Advancement to Candidacy:

All Master's students must file an official application for Candidacy for the Degree of Master of Science, after completing one-half of their course requirements and at least one quarter before completing all degree requirements. The Candidacy for the Degree of Master form can be found online at: <http://www.gradstudies.ucdavis.edu/forms/>. After the candidacy form has been signed by the Graduate Adviser and thesis chairperson (if Plan I, thesis plan), it is to be returned to Graduate Studies (normally routed via the Graduate Program Coordinator). Graduate Studies sends formal notices of advancement to candidacy to the chair of the thesis committee (for Plan I students), to the Graduate Program Coordinator for the program files, and to the student. If the student is not eligible for advancement, the program and student will be informed that action on the application has been deferred and of the reasons for the deferral (e.g. grade point average below 3.0, outstanding "I" grades in required courses or insufficient units). On the candidacy application, the student and the Graduate Adviser agree to and submit a statement of how the requirements for the degree under either Plan I or Plan II will be completed, including a list of courses the student will take to complete degree requirements. If changes need to be made in the program for the degree after advancement to candidacy, recommendations for such changes must be made in writing to Graduate Studies by the Graduate Adviser.

8) Comprehensive Examination and/or Thesis Requirements:

a) Thesis Requirements (Plan I):

Thesis committee meetings: The candidate and Major Professor should meet at least once a year with the other members of the thesis committee to discuss progress and any changes in research objectives.

Thesis: The MS Plan I Thesis Committee ensures that the quality of the thesis is appropriate for the degree. The topic should be acceptable to all three members of the committee, when they agree to serve. Expectations on length and level of scholarship appropriate to master's theses vary across faculty, and it is in the students' interest to ascertain these expectations from their committee members at the time they invite those members to serve.

The thesis should be submitted to the thesis committee *at least* one month before the student plans to finish the degree, to provide time to make requested revisions. Before the thesis is submitted to Graduate Studies for final approval, all committee members must approve it and sign the title page, certifying that the thesis has been completed to

their satisfaction. In case the committee members cannot reach a unanimous decision to accept the thesis but a majority is favorable, the majority and minority should report their separate opinions of its merits to the Dean of Graduate Studies, who will make the final decision according to the procedures outlined by Graduate Studies for dealing with divided graduate committees. If the thesis is regarded by the committee to be of less than acceptable quality, the student should be given an appropriate period of time, clearly specified by the committee, in which to improve the work. If, after that period of time (usually a quarter or more), the thesis is still unacceptable to a majority of the committee, the committee may recommend to the Dean of Graduate Studies that the student be disqualified from further graduate study in this program.

The thesis must be filed in a quarter in which the student is registered or on filing fee. Instructions on preparation of the thesis and a schedule of dates for filing the thesis in final form are available from Graduate Studies; the dates are also shown in the UC Davis General Catalog and in the Class Schedule and Registration Guide issued each quarter. A student must have a GPA of 3.0 for the MS degree to be awarded.

b) Comprehensive Examination (Plan II):

- i) Nature:** The 2-hour comprehensive examination is oral, and can cover any courses counted toward the completion of the MS. Students should ascertain in advance the general subject matter on which the committee will examine them and who will be on the committee. The MS exam is not “just a formality” and students should take it seriously. The questions are normally generated ad hoc by the members of the committee, although it is also possible for course instructors not on the Exam committee to submit questions that will be administered and graded by the committee. The number of questions asked is variable, depending on the time taken to answer questions and how the number of questions is counted (sub-questions, follow-up questions, and so on).
- ii) Timing:** Students normally take the comprehensive examination in, or soon after, their final quarter of coursework. It is important that the timing of the exam satisfy the regulations as noted in the CCGA handbook, which indicates that the capstone requirement be completed at or near the end of the coursework for the Master’s degree.. The student must have been advanced to candidacy by Graduate Studies and received from the program the Comprehensive Examination Report form, which will be completed after the examination. The time and place of the exam are arranged by the student, subject to the Committee’s availability. In cases where scheduling proves challenging, the major professor or Graduate Advisor will help facilitate scheduling.
- iii) Outcome:** The Exam committee’s unanimous vote is required to pass a student on the exam. If a student does not pass the entire exam, the committee may recommend that the student be reexamined one more time, but only if the Graduate Adviser concurs with the committee. The second exam is expected to take place within one quarter of the first exam, may cover all or part of the student’s MS coursework, and may be in a different format from the first exam (e.g. oral the first time and written the second time) at the discretion of the Exam committee. The examination may not be repeated more than once. A student who does not pass on the second attempt is subject to disqualification from further graduate work in the program.

Once passed, the Master’s Report Form (<http://www.gradstudies.ucdavis.edu/forms/>) is signed by the Program Graduate Adviser and then forwarded to the Office of Graduate Studies. The deadlines for completing this requirement are listed each quarter in the campus General Catalog (available online at the website of the Office of the Registrar or from the Bookstore). A candidate must be a registered student or in Filing Fee status at the time the program submits the form, with the exception of the summer period between the end of the Spring Quarter and the beginning of Fall Quarter. The program must file the report with Graduate Studies within one week of the end of the quarter in which the student’s degree will be conferred.

9) Normative Time to Degree:

The Master’s degree is either a Plan I (thesis) or Plan II (examination) program, designed to take one to two years. For Plan I students, the thesis could occupy 6-12 months of that period.

10) Typical Time Line and Sequence of Events: Normal time to complete MS, Plan I or II, is two years. Prerequisite deficiencies may extend this time.

TTP MS – Plan I and Plan II

Year One	Fall	Winter	Spring
	Core Course	Core Course	Core Course
	Track or Skill Course	Track or Skill Course	Track or Skill Course
	TTP 299	TTP 299	TTP 299
	TTP 281 – ITS-Davis Seminar Series	TTP 281 – ITS-Davis Seminar Series	TTP 281 – ITS-Davis Seminar Series
Year Two	Fall	Winter (advancement to Candidacy)	Spring (Thesis Due or Exam Taken)
	Track, Skill or Elective	Track, Skill or Elective	Track, Skill or Elective
	TTP 299	TTP 299	TTP 299
	TTP 281 – ITS-Davis Seminar Series	TTP 281 – ITS-Davis Seminar Series	TTP 281 – ITS-Davis Seminar Series

11) Sources of funding

Faculty research grants: These are grants obtained by individual faculty members or researchers (generically referred to as “PIs”, for “principal investigators”), and under their control. Students are hired under these grants as “graduate student researchers” (GSRs), *in accordance with the compensation plan approved for the degree program they are in.*

Unlike some programs, we do not make a GSR offer without first identifying the PI responsible for hiring and supporting the student. Thus, GSR offers are made through the student, Major Professor and PI (if not the Major Professor) finding each other directly. At the program administration level the TTP program may assist in suggesting matches but does not proactively create them.

Teaching assistant (TA) appointments: These are typically 25%- or 50%-time appointments for one or more academic quarters, to assist the instructor of a specific course (specific

duties will vary from one course/instructor to the next). TTP does not offer TA positions because it does not offer undergraduate courses. Students primarily obtain TA positions through the home departments of TTP faculty.

12) PELP, In Absentia and Filing Fee status.

Information about PELP (Planned Educational Leave), In Absentia (reduced fees when researching out of state), and Filing Fee status can be found in the Graduate Student Guide: <http://www.gradstudies.ucdavis.edu/publications/>

Ph.D. DEGREE REQUIREMENTS

1) Admissions Requirements:

Consideration for admission to PhD studies requires a bachelor's degree from an accredited institution, three letters of recommendation, official transcripts, scores on the General Test of the Graduate Record Examinations (GRE), TOEFL or IELTS score (if applicable), prerequisite course completion listing (see item a) below) and an Office of Graduate Studies online application with fee by the stated admission deadline. Students are generally admitted for the fall quarter, but exceptional cases for off-cycle admission can be considered. The decision whether to recommend admission to the Dean of Graduate Studies will be made by the Program Admissions Committee on the basis of available space, the competitiveness of applicant compared to the eligible pool, and whether a *major professor is available for the specialization proposed by the applicant*. Doctoral program applicants are strongly encouraged to communicate with potential research advisers (one of whom will become their Major Professor) in order to introduce themselves and inquire about faculty willingness to accept a new student in this degree program when applying to the program. This process of communicating with potential Major Professors should begin in the Fall, prior to the relevant applications deadline. Applicants should take the initiative to inquire about future research directions of the professors, exchange research ideas with potential Major Professors, and make every effort to identify viable possibilities. While formal acceptance into a research group cannot occur prior to admission, contacts should be far-enough developed such that at least tentative identification of a research adviser can be made as soon after the time of admission as possible.

- Doctoral students normally will have earned a minimum grade point average of 3.5 in their master's work.
- International students are expected to achieve a minimum score of 550 on the paper-based or 80 on the iBT Test of English as a Foreign Language (TOEFL), or an overall BAND score of 7 or more (on a 9-point scale) on the IELTS exam. TOEFL and IELTS scores expire after two years.

a) Prerequisites:

In addition to the admission requirements stated above, applicants are expected to have the equivalent of the following UC Davis courses:

- | | | |
|-------------------------------|---|-----------|
| • MAT 16A, MAT 17A or MAT 21A | Calculus (1) | 3-4 units |
| • MAT 16B, MAT 17B or MAT 21B | Calculus (2) | 3-4 units |
| • ECI 114, STA 100, STA 103 | Probability/Statistics (with calculus) | 4 units |
| • ECN 100A or ARE 100A | Microeconomics (preferably with calculus) | 4 units |

Questions regarding equivalent courses already taken should be addressed to the Graduate Coordinator and will be determined by the Program Admissions Committee

b) Deficiencies:

Calculus 1 and 2, Probability/Statistics (with calculus) and Microeconomics (preferably with calculus) must be completed before entering the program or soon afterward.

Courses taken to meet the prerequisites will not count toward the TTP degree. These

prerequisites may be taken on a pass/fail basis or in other ways but we caution students that a firm grasp of these subjects (at the level of an A or B letter grade) is important as a foundation for courses to be taken in this program. A form documenting the fulfillment of these requirements must be completed both at the time application is made to TTP or after enrolling at UC Davis for the first time if not all requirements had been met when applying.

2) Dissertation Plan:

Plan B: A three member (minimum) dissertation committee, an optional final oral examination (made on an individual student basis by the dissertation committee), and no exit seminar.

3) Course Requirements – Core, Tracks, Skill Areas and Electives (36 units)

a. Summary

The TTP PhD degree requires 25-32 units of coursework in the core, track, and skill areas and elective courses to sum to 54 units in all. TTP 299 work does not count toward the total. At least 36 units must be at the graduate level. In addition, TTP 281 is required six times but these do not count in the units total (see notes below). Full-time students must enroll for a minimum of 12 units per quarter including research, academic and seminar units. Courses that fulfill any of the program course requirements may not be taken S/U unless the course is normally graded S/U. Once course requirements are completed, students can take additional classes as needed, although the 12 units per quarter are generally fulfilled with a research class (299) and perhaps seminars. Per UC regulations, students cannot enroll in more than 12 units of graduate level courses (200) or more than 16 units of combined undergraduate and graduate level (100, 200, 300) courses per quarter.

b. Core Courses (12 units)

CORE CLASSES		
TTP 210 (4 units) Transportation Technology	TTP 220 (4 units) Transportation Policy	ECI 254 (4 units) Data Science ¹
TTP 281 ITS-Davis Seminar: 2 years (6 quarters) ²		

¹Students with prior experience with data science may substitute an additional course from one of the track or skill areas (see below) for this course, with permission of the graduate advisor.

²Students are required to enroll in the weekly ITS Seminar (TTP 281) each quarter during the first two years of their program. The requirement to enroll in any given quarter can be postponed by petition to the Graduate Adviser, for academic reasons such as conflicting course schedules or recurring research obligations. Postponed enrollments are expected to be made up in the future,

unless of course the terminal degree is completed first. These units do not count toward the 54 required to complete the PhD.

c. Track (at least 6 to 8 units from one track)

TRACK		
PhD – at least 2 courses from one track		
Vehicles and Fuels	Demand and Behavior	Infrastructure and Operations
<p>The transportation-energy nexus, and enabling and transformative technologies</p>	<p>Societal needs for mobility and strategies for meeting those needs</p>	<p>Challenges in designing, operating, and maintaining the transportation system</p>
<ul style="list-style-type: none"> ▪ TTP 289A Transportation Energy Modeling (4 units) ▪ EGG 202/ECN 216 Energy & Climate Policy (4 units) ▪ MAE 258 Hybrid Electric Vehicle System Theory and Design (4 units) ▪ MAE 269 Fuel Cell Systems (4 units) ▪ MAE 234 Design and Dynamics of Road Vehicles (4 units) ▪ EBS 216 Energy Systems (4 units) ▪ MAE 218 Advanced Energy Systems (4 units) ▪ EMS 170 Sustainable Energy Technologies (4 units) ▪ EBS 120 Power Systems Design (4 units) ▪ EME 163 Internal Combustion Engines and Future Alternatives (4 units) 	<ul style="list-style-type: none"> ▪ TTP 289A Behavioral Theories Seminar (1-5 units) ▪ ECI 251 Transportation Demand Analysis (4 units) ▪ ECI 289H Sustainable Freight Transportation (1-5 units) ▪ LDA 205 Urban Planning and Design (4 units) ▪ ESP 171 Urban and Regional Planning (4 units) ▪ MGT 249 Marketing Research (3 units) ▪ TTP 289A Discrete Choice Modeling (4 units) 	<ul style="list-style-type: none"> ▪ ECI 251 Transportation Demand Analysis (4 units) ▪ ECI 256 Urban Traffic Management and Control (4 units) ▪ ECI 257 Flow in Transportation Networks (4 units) ▪ ECI 268 Infrastructure Economics (3 units) ▪ TTP 289A Pavements for Managers and Policymakers (1-5 units) ▪ TTP 289A Bicycle and Pedestrian Planning (1-5 units)

d. Skill Areas (at least 9 to 12 units from one or more areas)

SKILL AREAS						
PhD – at least 3 courses						
Economics	Data Analysis	Mathematical Modeling	Technology/ Infrastructure Assessment	Policy Analysis	Social Science Research	Experimental Design
Economic theory and econometric modeling	Statistical modeling and data analysis techniques	Mathematical modeling including linear/nonlinear programming and stochastic models	Tools and techniques for assessing impacts of technology and infrastructure	Theory and techniques for assessing policy	Methods for social science research	Design and analysis of experiments
ARE 175/ESP175 (4 units) ARE 176 (4 units) ARE 204A (4 units) ARE 256A (4 units) ARE 275 (4 units) ECN 125 (4 units) ECN 145 (4 units)	STA 106 (4 units) STA 108 (4 units) STA 138 (4 units) STA 141A (4 units) STA 141B (4 units) STA 141C (4 units) STA 206 (4 units) STA 208 (4 units) PLS 206 (4 units) GEO 200CN (4 units) TTP 289A Data Analysis (4 units)	ECI 249 (4 units) ECI 253 (4 units) ARE 252 (4 units) ARE 254 (4 units) PHY 204A (4 units) MAT 258 A/B (4 units)	ECI 244A (4 units) ECI 269 (4 units) EBS 216 (4 units) ESP 179 (4 units) ABT/LDA 150 (4 units)	ESP 212A (4 units) ESP 212B (4 units) ARE 275 (4 units) POL 207 (4 units) POL 208 (4 units)	TTP 289A Survey Workshop (1-5 units) PSC 207 (4 units) ESP 278 (3 units) CMN 211 (4 units) ANT 206 (5 units) POL 210 (4 units)	MAE 207 (4 units) EBS 265 (5 units) PLS 205 (5 units)

e. Elective Courses (22 or more units)

Students are encouraged to choose additional courses beyond the minimum required from the track and skill areas as listed above but they may choose elective courses from the following list. Although a number of approved courses are undergraduate level, be aware of the restrictions on the minimum number of units (24) that must be taken at the graduate level.

Transportation/Environment Planning/Policy

TTP 282 Transportation Orientation Seminar (1 unit)
ECI 165 Transportation Policy (3 units)
ECI/ESP 163 Energy and Environmental Aspects of Transportation (4 units)
ECI 258 Transportation Planning in Developing Countries (3 units)
ECI 269 Transportation-Air Quality: Theory and Practice (4 units)
ECL 213 Population, Environment, and Social Structure (4 units)
ESP 167 Energy Policy (4 units)
TTP 289A Energy Journal Review (1 unit)

Policy Process

POL 175 Science, Technology and Policy (4 units)
POL 187 Administrative Theory (4 units)
POL 208 Policy Analysis (4 units)
ESP 168A Methods of Environmental Policy Evaluation (5 units)

Land Use/Urban Planning

ARE 144 Real Estate Economics (3 units)
CRD 171 Housing and Social Policy (4 units)
CRD 240 Community Development Theory (4 units)
CRD 245 Political Economy of Urban and Regional Development (4 units)
LDA 180G Special Topics in Landscape Architecture: Landscape & Regional Land Planning (2 units)
LDA 180L Special Topics in Landscape Architecture: Public Open Space (2 units)
LDA 180M Special Topics in Landscape Architecture: Urban and Community Design (2 units)
LDA 181M Urban and Community Design: Design and Planning Studio (2 units)
LDA 201 Theory and Philosophy of the Designed Environment (4 units)

Economics

ARE 100B Intermediate Microeconomics: Imperfect Competition, Markets, and Welfare (4 units)
ARE 130 Agricultural Markets (4 units)
ARE 176 Environmental Economics (4 units)
ARE 276 Environmental Economics (4 units)
ECI 268 Infrastructure (Public Works) Economics (3 units)
ECN 101 Intermediate Macro Theory (4 units)
ECN 200D Macroeconomic Theory (5 units)

Marketing/Management

ARE 136 Managerial Marketing (4 units)
ENG 250 Technology Management (3 units)
*MGT 240 Management Policy and Strategy (3 units)
*MGT 251 Management of Innovation (3 units)
*MGT 293 Topics in Marketing (3 units)

**Courses offered through the Graduate School of Management have very limited enrollment and are open to non-MBA students on a space-available basis.*

Behavioral Sciences

ANT 104N Cultural Politics of the Environment (4 units)
ANT 127 Urban Anthropology (4 units)
ANT 211 Advanced Topics in Cultural Ecology (4 units)
ANT 222 Cities and Citizenship (4 units)
CMN 170 Communication, Technology, and Society (4 units)
CRD 162 People, Work and Technology (4 units)
HIS 172 American Environmental History (4 units)
POL 279 Political Networks: Methods and Applications (4 units)
PSC 155 Environmental Awareness (4 units)
SOC 141 Industrialization and Social Change (4 units)
SOC 143A Urban Society (4 units)
SOC 143B Sociology of City Life (4 units)
SOC 160 Sociology of the Environment (4 units)

Air Quality/Emissions

ATM 116 Climate Change (4 units)
ECI 149 Air Pollution (4 units)
ECI 242 Air Quality (4 units)
ECI 269 Transportation-Air Quality: Theory and Practice (4 units)
EME 161 Combustion and the Environment (4 units)
ESM 131 Air as a Resource (3 units)

GIS/Remote Sensing

ABT 180 Introduction to Geographic Information Systems (4 units)
ABT 181N Concepts and Methods in Geographic Information Systems (4 units)
ABT 182 Environmental Analysis using GIS (4 units)
ESM 186 Environmental Remote Sensing (3 units)

Quantitative Methods

EAD 116 Computer Solution of Physical Problems (4 units)
EAD 116 Computer Solution of Physical Problems (4 units)
ECS 171 Machine Learning (4 units)

Transportation and Infrastructure Systems

ECI 143 Green Engineering Design and Sustainability (4 units)
ECI 161 Transportation Systems Engineering (4 units)
ECI 162 Transportation Land Use Sustainable Design (4 units)
ECI 179 Pavement Engineering (4 units)
ECI 250 Civil Infrastructure System Optimization and Identification (4 units)
ECI 253 Dynamic Programming and Multistage Decision Processes (4 units)
ECI 282 Pavement Design and Rehabilitation (4 units)
TTP 289A Energy Journal Review (1 unit)

Vehicle Design

EME 134 Vehicle Stability (4 units)
EME 161 Combustion and the Environment (4 units)

EME 163 Internal Combustion Engines and Future Alternatives (4 units)
MAE 216 Advanced Thermodynamics (4 units)
MAE 217 Combustion (4 units)
MAE 218 Advanced Energy Systems (4 units)
MAE 226 Acoustics and Noise Control (4 units)
MAE 234 Design and Dynamics of Road Vehicles (4 units)
MAE 236 Aerodynamics in Nature and Technology (4 units)
MAE 258 Hybrid Electric Vehicle Theory and Design (4 units)
MAE 269 Fuel Cell Systems (4 units)

Statistics/Quantitative Methods

PLS 205 Experimental Design and Analysis (5 units)
ARE 106 Quantitative Methods in Agricultural Economics (4 units)
EAD 115 Numerical Solution of Engineering and Scientific Problems (4 units)
ECN 140 Econometrics (4 units)
ARE/ECN 240A Econometric Methods (4 units)
ARE/ECN 240B Econometric Methods (4 units)
ARE/ECN 240C Time Series Econometrics (4 units)
PSC 204A Statistical Analysis of Psychological Experiments (4 units)
PSC 204B Causal Modeling of Correlational Data (4 units)
PSC 204C Applied Psychometrics and Measurement Theory (4 units)
PSC 204D Advanced Statistical Inference from Psychological Experiments (4 units)
PSC 205A Applied Multivariate Analysis of Psychological Data (4 units)
PSC 205B Factor Analysis (4 units)
PSC 205C Structural Equation Modeling (4 units)
STA 130 Mathematical Statistics: Brief Course (4 units)
STA 131A Introduction to Probability Theory (4 units)
STA 131B,C Mathematical Statistics (4 units)
STA 135 Multivariate Data Analysis (4 units)
STA 137 Applied Time Series Analysis (4 units)
STA 138 Analysis of Categorical Data (4 units)
STA 142 Reliability (4 units)
STA 144 Sampling Theory of Surveys (4 units)
STA 205 Statistical Methods for Research with SAS (4 units)
STA 222 Biostatistics: Survival Analysis (4 units)
STA 223 Biostatistics: Generalized Linear Models (4 units)

Qualitative Methods

ANT 138 Ethnographic Research Methods in Anthropology (4 units)
CRD 151 Community Field Research: Theory and Analysis (4 units)

Operations Research

ARE 155 Quantitative Analysis for Business Decisions (4 units)
ARE 253 Optimization Techniques with Economic Applications (4 units)
ARE 255 Advanced Topics in Economic Dynamics (3 units)
ECI 153 Deterministic Optimization and Design (4 units)

Mathematics

MAT 108 Introduction to Abstract Mathematics (4 units)
MAT 227 Mathematical Biology (4 units)

MAT 258A Numerical Optimization (4 units)

Other

*MGT 290 Fundamentals of Energy Efficiency (3 units)

TTP 292 Internship in Transportation Technology and Policy (units vary)

TTP 396 Teaching Assistant Training Practicum (units vary)

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4) Special Requirements: N/A

5) Committees:

a) Admissions Committee:

Once the completed application, all supporting material, and the application fee have been received, the application will be reviewed through the online application system by faculty. Faculty comments in the online system regarding suitability for admission and willingness to serve as a mentor will be reviewed by the Program Admissions Committee consisting of the Graduate Advisers. After committee review, recommendations for admission will be forwarded by the Graduate Adviser with Admission Authority to the Dean of Graduate Studies for final approval of admission. Notification of admissions decisions will be sent by Graduate Studies.

There are three different deadlines for applications. The dates will be published each year at the beginning of the admission cycle:

- **Priority for consideration of financial support:** Applicants who submit their graduate application by the Priority Deadline will receive priority review for admission.
- **General:** Applicants who submit their graduate application by the General Deadline (but after the Priority deadline) will be formally reviewed for admission by the graduate program but not on a priority basis.
- **Space Available:** Applicants who submit their graduate application by the Space Available Deadline (but after the General Deadline) are not guaranteed to have their application reviewed by the graduate program. Their application will be reviewed only if the graduate program determines that they have additional space available after reviewing Priority and General Deadline applicants.

Admissions for other than Fall quarter may be accepted for extraordinary circumstances and depending upon space.

b) Course Guidance or Advising Committee

All students require a three-person guidance committee who approves their Program of Study, and is responsible for monitoring their progress in the program. Members of this committee are proposed by the student and must be approved by the student's Major Professor (or conversely), and approved by the Graduate Adviser. The Major Professor is selected by the student with assistance from the program, if needed. Non-voting members of TTP can serve on guidance committees without special approval, but at least two members of the guidance committee, normally including the chair, must be

Academic Senate members or Academic Federation members of TTP who have instructional appointments. The chair must be a member of the TTP graduate group, and normally at least one other committee member will also be a member of the TTP graduate group.

A student should consult with his/her Major Professor to select a guidance committee as soon as possible, but no later than the end of their second quarter of study. The guidance committee is responsible for providing advice in formulating the “Program of Study”. In consultation with his/her guidance committee, a student should develop a “Program of Study” no later than the second quarter of study. All “Programs of Study” must be approved by the Graduate Adviser, but it is understood that they are subject to change as individuals’ studies evolve.

c) **Qualifying Examination Committee:**

The student, in consultation with his/her Major Professor and graduate advisor, gains confirmation of five faculty to serve on the Examination Committee. The program can provide assistance with the development of this Examination Committee, if needed. A Graduate Advisor reviews the names and, if approves, submits these nominations to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy. The Major Professor does not serve as Chair of the committee. The QE Committee conducts the exam and submits results to the Office of Graduate Studies.

The five-person examination committee normally is composed of three or four people representing the student’s chosen track, and one or two persons representing the other track. At least three members of the examination committee must be voting members of the TTP Graduate Group.

To ensure that the committee is capable of covering core, track and skills areas, students are required to complete a form documenting the members of their committee and the areas that each committee member is responsible for. This form, found on TTP website, should be completed in consultation with the respective committee members.

d) **Dissertation Reading Committee:**

PhD students will require a three (or more)-person dissertation committee, which provides guidance in formulating and carrying out a doctoral research project and signs the dissertation when it is satisfactorily completed. Members of this committee are proposed by the student and must be agreed-to by the student’s Major Professor (or conversely) and approved by the Graduate Adviser. The committee must also be approved by Graduate Studies. The Major Professor is normally the chair of the dissertation committee; the other two members are selected based on their interest and involvement in the student’s research. The Chair must be a member of the TTP Graduate Group. Academic Senate members of TTP are automatically eligible to serve on this committee. Academic Federation members of TTP who have instructional appointments and are approved by Graduate Studies may also serve on this committee. Non-voting members of TTP can serve on thesis/dissertation committees following the Policy on Service on Advanced Degree Committees. A 4-person dissertation committee must have at least two Academic Senate members.

6) **Advising Structure and Mentoring:**

The **Major Professor** is a TTP faculty member who supervises the student's research and thesis; this person serves as the Chair of the Thesis Committee. The **Graduate Adviser**, who is appointed by Graduate Studies, is a resource for information on academic requirements, policies and procedures, and registration information until the Course Guidance Committee is formed. The **Graduate Program Staff** assists students with identifying a Major Professor, identifying appointments, and general university policies.

The **Mentoring Guidelines** can be found at <http://gradstudies.ucdavis.edu/gradcouncil/mentoring.pdf>

7) **Advancement to Candidacy:**

Before advancing to candidacy for a doctoral degree, students must have satisfied all requirements set by the graduate program, must have maintained a minimum GPA of 3.0 in all course work in the approved Program of Study (except those courses graded S or U), and must have passed the Qualifying Examination before a committee appointed to administer that examination. Normally, students advance by the end of the 9th quarter. The student must file the appropriate paperwork with the Office of Graduate Studies and pay the candidacy fee in order to be officially promoted to Ph.D. Candidacy. Refer to the Graduate Council website for additional details regarding the Doctoral Qualifying Examination at <http://gradstudies.ucdavis.edu/gradcouncil/policiesall.html>.

8) **Preliminary Examination, Qualifying Examination and Dissertation requirements:**

a) **Preliminary Examination**

There is no Preliminary Exam.

b) **Qualifying Examination**

1. **General Information**

All students will complete all course requirements before taking their Qualifying Examination. Passing this exam makes the student eligible for advancement to candidacy. The qualifying exam should be taken during the second or third year but not later than the end of the third year after admission to the Ph.D. program.

The primary purpose of the Qualifying Examination (QE) is to validate that the student is academically qualified to conceptualize a research topic, undertake scholarly research and successfully produce the dissertation required for a doctoral degree. The QE must evaluate the student's command of the field, ensuring that the student has both breadth and depth of knowledge, and must not focus solely on the proposed dissertation research. In addition, the QE provides an opportunity for the committee to provide important guidance to the student regarding his or her chosen research topic.

2. Written Portion of the Exam – Dissertation Prospectus

At a minimum the written portion of the exam consists of a research proposal called the Dissertation Prospectus. It is a document of anywhere from 15 pages and upward, describing the student's dissertation-specific research aims, hypotheses, progress to date, and approach. The Prospectus should be provided to members of the qualifying examination committee at least 10 days before the oral portion of the exam.

The Prospectus is an independently prepared proposal describing the student's dissertation-specific research aims, hypotheses, progress to date, and experimental approach. Concepts within the research proposal can be discussed with others (such as the student's Major Professor and peers), but the writing of the proposal should be solely the student's work (i.e., no editorial assistance is allowed) as the proposal will serve as evidence of the student's proficiency in scientific writing.

The qualifying exam committee will be responsible for assessing that the student's writing proficiency is satisfactory before advancement to candidacy. Furthermore, the Prospectus will provide information that may be discussed during the oral exam.

3. Oral Portion of the Exam

The oral portion of the qualifying exam will be 3 hours in length and is intended to demonstrate the student's critical thinking ability, powers of imagination and synthesis, and broad knowledge of the field of study.

The committee will evaluate the student's general qualifications for a respected position as an educator or leader as well as the student's preparation in a special area of study based upon relevant portions of the student's previous academic record, performance on specific parts of the examination, and the student's potential for scholarly research as indicated during the examination.

In principle, the exam can cover any aspect of the coursework included in the student's program of study, as well as the span of knowledge required to successfully complete the proposed research. In practice, naturally, time constraints and the collective expertise of the committee will limit the subjects that are likely to be covered on the exam.

4. Outcome of the Exam

The committee will reach a decision on the student's performance immediately after the oral exam. The committee, having reached a unanimous decision, shall inform the student of its decision to:

- “Pass” (no conditions may be appended to this decision),
- “Not Pass” (the Chair's report should specify whether the student is required to retake all or part of the examination, list any additional requirements, and state the exact timeline for completion of requirements to achieve a “Pass”), or
- “Fail”.

If a unanimous decision takes the form of “Not Pass” or “Fail”, the Chair of the QE committee must include in its report a specific statement, agreed to by all members of the committee, explaining its decision and must inform the student of its decision. Having received a “Not Pass” the student may attempt the QE one additional time; the QE report must list the specific conditions and timing for the second exam. After a second examination, a vote of “Not Pass” is unacceptable; only “Pass” or “Fail” is recognized. Only one retake of the qualifying examination is allowed. Should the student receive a “Fail” on the first or second attempt at the exam, the student will be recommended for disqualification from the program to the Dean of Graduate Studies.

c) **The Dissertation**

1. Exit Seminar

The dissertation follows Plan B with no required exit seminar. Students are encouraged to give a seminar on their findings near the completion of their dissertation.

2. Dissertation: General Requirements

Filing of a Ph.D. dissertation with the Office of Graduate Studies is normally the last requirement satisfied by the candidate. The deadlines for completing this requirement are listed each quarter in the campus General Catalog (available online at the website of the Office of the Registrar or from the Bookstore). A candidate must be a registered student or in Filing Fee status at the time of filing a dissertation, with the exception of the summer period between the end of the Spring

Quarter and the beginning of Fall Quarter. The Ph.D. Dissertation will be prepared, submitted and filed according to regulations instituted by the Office of Graduate Studies <http://gradstudies.ucdavis.edu/students/filing.html>. Satisfaction of this requirement must be verified by the Dissertation Committee Chair.

3. Dissertation:

The research conducted by the student must be of such character as to show ability to pursue independent research. The dissertation reports a scholarly piece of work of publishable quality that solves a significant scientific problem in the field and is carried out under the supervision of a member of program while the student is enrolled in the program. The chair of the dissertation committee must be a member of the program and must be continuously involved with the planning and execution of the experimental work done to formulate the dissertation. The Major Professor’s UC Davis laboratory is the setting for most of the student’s research activities, unless an alternative site and off-site supervision are approved in advance by the TTP Graduate Adviser.

Students should meet regularly with their dissertation committee. The dissertation must be submitted to each member of the dissertation committee at least one month before the student expects to make requested revisions; committee members are expected to respond within 4 weeks, not including summer months for nine month faculty. Informing committee members of progress as writing proceeds helps the members to plan to read the dissertation and provide feedback within this time frame. The dissertation must be approved and signed by the dissertation committee before it is

submitted to Graduate Studies for final approval.

A dissertation on a subject chosen by the student, bearing on the principal subject of study, and of such character as to show ability to prosecute independent investigation, must be approved by the committee in charge of the dissertation and by Graduate Studies before the degree will be recommended. Special emphasis will be on this requirement, and the degree will in no case be granted merely for the faithful completion of a course of study, however extensive.

The dissertation will 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; and
- the dissertation must be tied together by a unifying theme.

Either the monograph or the “three-paper” format may be used at the discretion of the student’s Dissertation Committee. In either case, however, 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.

9) **Normative Time to Degree**

Normative Time is the elapsed time (calculated to the nearest quarter) that students need to complete all requirements for the degree, assuming that they are engaged in full-time study and making adequate progress. There are two parts to Normative Time: Normative Time to Advancement to Candidacy and Normative Time in Candidacy. The first represents the number of quarters needed to complete all of course requirements and pass the Qualifying Exam; the second represents the number of quarters needed to complete the dissertation after advancing to candidacy.

Normative time to advancement to candidacy will differ depending on whether the student has previously earned a relevant MS or not, in which case the time to first complete a TTP MS is included in the table for information. If an MS in TTP is earned at UC Davis, all 30 (Plan I) - 36 (Plan II) units of coursework needed for the MS can be applied toward the PhD. If an MS at UC Davis is in a related area, perhaps fewer than the maximum number of units will be transferable. If an MS is earned at another university, up to 27 units can be transferred toward the PhD in TTP at UC Davis. The table below presents the normative times to advancement to candidacy under each of three scenarios. All three assume that all prerequisites have been completed prior to enrollment. Note that the normative time *in* candidacy does not depend on the possession of a prior MS.

	After prior TTP MS (UCD)	With prior relevant MS (non-UCD)	With no prior MS
Normative time till advancement to candidacy	1 year	1-2 years	2-3 years
Normative time in candidacy	2-3 years	2-3 years	2-3 years
TOTAL	3-4 years	3-5 years	4-6 years

10) Typical Time Line and Sequence of Events TTP PhD with prior relevant MS (non-UCD)

Year One	Fall	Winter	Spring
	Core Course	Core Course	Core Course
	Track or Skill Course	Track or Skill Course	Track or Skill Course
	TTP 299	TTP 299	TTP 299
	TTP 281 – ITS-Davis	TTP 281 – ITS-Davis	TTP 281 – ITS-Davis Seminar
Year Two	Fall	Winter	Spring
	Track, Skill or Elective Course	Track, Skill or Elective Course	Track, Skill or Elective Course
	TTP 299	TTP 299	TTP 299
		Qualifying Exam Preparation	Qualifying Exam Preparation
	TTP 281 – ITS-Davis Seminar Series	TTP 281 – ITS-Davis Seminar Series	TTP 281 – ITS-Davis Seminar Series
	Summer: advancement to Candidacy		
Years Three-Five	Dissertation Research and Completion		

11) Sources of funding

Faculty research grants: These are grants obtained by individual faculty members or researchers (generically referred to as “PIs”, for “principal investigators”), and under their control. Students are hired under these grants as “graduate student researchers” (GSRs), *in accordance with the compensation plan approved for the degree program they are in.*

Unlike some programs, we do not make a GSR offer without first identifying the PI responsible for hiring and supporting the student. Thus, GSR offers are made through the student, Major Professor and PI (if not the Major Professor) finding each other directly. At the program administration level the TTP program may assist in suggesting matches but do not proactively create them.

Teaching assistant (TA) appointments: These are typically 25%- or 50%-time appointments for one or more academic quarters, to assist the instructor of a specific course (specific duties will vary from one course/instructor to the next). TTP does not offer TA positions because it does not offer undergraduate courses. Students primarily obtain TA positions through the home departments of TTP faculty.

12) PELP, In Absentia and Filing Fee status.

Information about PELP (Planned Educational Leave), In Absentia (reduced fees when researching out of state), and Filing Fee status can be found in the Graduate Student Guide: http://gradstudies.ucdavis.edu/students/handbook/GS201_GraduateStudentGuide.pdf.

13) Leaving the Program Prior to Completion of the PhD Requirements.

Should a student leave the program prior to completing the requirements for the PhD, they may still be eligible to receive the Masters if they have fulfilled all the requirements (see Master's section). Students can use the Change of Degree Objective form available from the Registrar's Office: http://registrar.ucdavis.edu/local_resources/forms/D065-graduate-major-degree-change.pdf.