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| Course Number | CE 455/555 Fall Quarter 2008 |
| Title | Intelligent Transportation Systems |
| Section | 001 |
| CRN(s) | 10484/10495 |
| Credits | 4 |
| Design Credits | 1.5 |
| Prerequisite(s) | CE 351. CE 454 Recommended. |
| Days/Time | Tuesdays and Thursdays 12:00-1:50 |
| Location | EB 310 |
| Final Exam Day/Time | Thursday, December 11, 1015-1205, EB 310 |

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| Course Website | http://www.bertini.org . |
| Course Wiki | https://wiki.cecs.pdx.edu/bin/view/Main/ItsCourse |

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| Instructor | Dr. Robert L. Bertini, P.E. |
| Office | EB Room 301A |
| Phone & Voicemail | 503-725-4249 |
| E-mail | bertini@pdx.edu |
| Office Hours | TR 3-4 and at any other time by appointment or if I'm in the office. You're encouraged to call, email and stop by the office if you need assistance of any kind in this class, other classes, developing your resume, finding internships, jobs, etc. |
| Mailbox Location | CEE Office, Engineering Building, Suite 200 |

- Required Text:**
- *Intelligent Transportation Systems Primer*, Institute of Transportation Engineers, 2000.
 - *Loose leaf notebook for organizing course handouts and other materials*

Other Reading:

ITS/Operations Resource Guide 2008: <http://www.resourceguide.its.dot.gov/>
 ITS Joint Program Office: <http://www.its.dot.gov/index.htm>
 ITS Technology Overview: <http://www.itsoverview.its.dot.gov/>
 ODOT ITS: <http://www.oregon.gov/ODOT/HWY/ITS/>
 Oregon Regional ITS Integration Program: Final Phase II Report,
http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13682.html

Other readings to be distributed in class.

Catalog Course Description: *Introduction to intelligent transportation systems, including: enabling surveillance, navigation, communications and computer technologies. Application of technologies for monitoring, analysis, evaluation and prediction of transportation system performance. Intervention strategies, costs and benefits, safety, human factors, institutional issues and case studies.*

Course Description:

The class is organized into four modules. The first section overviews ITS systems and applications. Next, the enabling technologies in communications and information processing are discussed. Third, application of these technologies to implementation of ITS is discussed including planning and feasibility studies, systems integration and standardization, human factors issues, and institutional factors. The final module presents case studies of specific

ITS projects.

Students will work individually on an ITS research project, under the supervision of the instructor. A clearinghouse of possible topics and projects will be established at the beginning of the quarter. It is anticipated that the projects would encompass most of the areas of ITS applications, including but not limited to:

- Advanced Traffic Management and Traveler Information Systems (ATMIS)
- Advanced Public Transportation Systems (APTS)
- Commercial Vehicle Operations (CVO)
- Advanced Vehicle Control and Safety Systems (AVCSS)
- System Integration, Deployment and Institutional Issues

Course Objectives – Students must demonstrate the ability to:

1. Understand the breadth and depth of the field of intelligent transportation systems.
2. Be familiar with terminology and standards.
3. Incorporate ITS elements into their professional activities.
4. Critically evaluate ITS claims, proposals and projects.
5. Perform individual research and communicate to colleagues and instructor.

Course Requirements:

- Lecture materials and announcements.
- Assigned readings should be done prior to the relevant class.
- Do homework on one side of letter-sized (grid preferred) paper. Use plenty of paper, if hand-written use legible block lettering and professional presentation standards. It would be great if you staple your un-folded homework in the upper left corner.
- ITS special topic oral and written presentation
- Attendance mandatory for the project presentations.
- Midterm and Comprehensive final exams will be open book and possibly take-home.
- All written responses in this course shall be in your own words.

Course Grading

Students will be evaluated on the following course components:

| Assignment | Points Assigned or % of Total Grade |
|-----------------------------|--|
| Special Topics Proposal | 5% |
| Assignments | 45% |
| Midterm | 15% |
| Special Topics Presentation | 15% |
| Final Exam | 15% |
| <hr/> | |
| <i>TOTAL</i> | <i>100%</i> |

A curve will be used to determine the final course letter grade. Students with disabilities should discuss any arrangements that will enhance their learning in this class with the instructor.

Professionalism

All assignments and class participation should be conducted in a professional manner. Attention to detail on class assignments and communication is important and is part of the learning experience in this course.

Incompletes

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

Program requirements

The CEE Department requires that junior and senior engineering courses must be completed with a minimum grade of C-, and a student's cumulative PSU GPA must be 2.25 or higher to graduate from the BSCE program.

Tentative Schedule (Subject to Modification)

| No | Date | Topic | Reading Chapter |
|----|---------|---|---------------------------|
| 1 | T 9/30 | MODULE I: SYSTEMS & APPLICATIONS Introduction/Overview/ITS Project Topic Discussion | |
| 2 | R 10/2 | GUEST SPEAKERS <i>Policy Framework for ITS in the Portland Metropolitan Region,</i> Deena Platman <i>TriMet's Role in the Regional ITS Framework,</i> David Crout | |
| 3 | T 10/7 | Research Tools Introduction to ITS Architecture | 1, 2 |
| 4 | R 10/9 | Management Tools: Surveillance Traffic Management Systems Special Topics Proposal Due on wiki | 3, 4 |
| 5 | T 10/14 | Emergency/Incident Management Traveler Information Systems & Evaluations | PS1 Due 5, 6, 7 |
| 6 | R 10/16 | Electronic Payment Systems Vehicle-based Control and Safety Systems | 8, 9, 10 |
| 7 | T 10/21 | Prediction and Intervention Public Transportation Systems | 11, 12, 13 |
| 8 | R 10/23 | Commercial Vehicle Systems Rural ITS | 14, 15, 16 |
| 9 | T 10/28 | MODULE II: TECHNOLOGY Weather Information Systems <i>Review for Midterm</i> | 17, 18 |
| 10 | R 10/30 | MIDTERM EXAM | |
| 11 | T 11/4 | Communications Information Technology | PS2 Due 19, 20, 21 |
| 12 | R 11/6 | Navigation Systems Dynamic Route Guidance | 22, 23 |
| 13 | T 11/11 | HOLIDAY: University Closed | |
| 14 | R 11/13 | MODULE III: IMPLEMENTATION Planning and Feasibility Studies ITS Standards System Integration/Standards | PS3 Due 24, 25 |
| 15 | T 11/18 | GUEST SPEAKER Nathaniel T. Price, FHWA Oregon Division <i>ITS Architecture</i> | |
| 16 | R 11/20 | GUEST SPEAKER Jim Peters, DKS Associates; <i>ITS Planning Process</i> | |
| 17 | T 11/25 | MODULE V: CASE STUDIES Traffic Management/Traveler Information Systems Advanced Vehicle Control and Safety Systems International Applications | 26, 27 |
| | R 11/27 | HOLIDAY: University Closed | |
| 18 | T 12/2 | Student Special Topic Presentations | Pres Due |
| 19 | R 12/4 | Student Special Topic Presentations | |
| 20 | T 12/11 | Final Exam Period 1015-1205 EB 310 | |

Chapter Responsibilities

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|-------------------|----|----|
| Alex Bigazzi | 1 | 15 |
| Josh Crain | 2 | 16 |
| Bryan Hangartner | 3 | 17 |
| David Amiton | 4 | 18 |
| Heba Alwakiel | 5 | 19 |
| Chengyu Dai | 6 | 20 |
| Raymond Delahanty | 7 | 21 |
| Wei Feng | 8 | 22 |
| Kristie Gladhill | 9 | 23 |
| Ping Guo | 10 | 24 |
| Todd Johnson | 11 | 25 |
| Rolando Melgoza | 12 | 26 |
| Amanda Owings | 13 | 27 |
| Meead Saberi | 14 | |

Special Topics Presentation

A special topics presentation based on a relevant topic in intelligent transportation systems, which is of interest to the student, is required as an integral part of this course. The topic will be selected in close consultation with the instructor. If this is your first presentation for a graduate class, you are particularly encouraged to seek individual guidance from the instructor. The special topics presentation will be developed as follows:

- September 30, 2008 Discussion of possible special topics.
- October 9, 2008 Special topics proposal due on wiki.
- December 2-4, 2008 Special topics presentations during class periods.

Specific requirements and expectations for the presentation are presented below:

Topics

Select a topic that is of interest to you, and that is reasonable in scope--not too narrow, and not too broad. In addition, be sure that there is plenty of information relating to your topic in easily obtainable sources. In selecting your topic, you should think beyond presenting simply history, or a literature survey; you should think of what new ideas and innovative solutions you can add to a particular topic. The presentation should be given in your own words, with careful attention to proper citation of sources.

Proposal

Your proposal is due on the class wiki on October 9, 2008 and is **limited to two pages** (typed/word processed) and shall include the following:

- Your name
- Presentation title
- Specific **objectives** in bullet format (where you're going)
- Preliminary outline of presentation, in table of contents format (how you're going to get there)
- Evidence of preliminary library and literature research. This should include a list of library references (minimum of ten relevant journal articles or technical reports). NOTE: The references must be submitted using the proper TRB reference format described below (do not simply paste TRIS or MELVYL results).

Introduction to Library and Literature Research

With the advent of the Internet it is very tempting to think that all necessary resources for a project will be available in full text after typing in a few words at Google.com. This notion should be discarded immediately. We will discuss the concepts of library and literature research, involving your need to access real books and articles contained in refereed/archival journals. You will need to use real library search tools and will also need to go to the library and physically touch some sources of information.

Note that for this course transportation textbooks and web sites do not count as library references. Several good sources for finding transportation journal articles and other documents are:

- National Transportation Library www.bts.gov/NTL
- TRIS Online <http://ntl.bts.gov/tris>
- Melvyl index <http://melvyl.cdlib.org>

NOTE: Library references for most relevant documents will be provided as output from your searches using these tools. You will have to actually look up the document in the PSU library or request it through interlibrary loan.

Be sure to make use of the Vikat catalog, go to the PSU library home page at <http://vikat.pdx.edu>. Also available on the library home page <http://www.lib.pdx.edu> are Full Text Electronic Journals: <http://wg5rp2ll8a.search.serialssolutions.com>, and a list of on-line Databases: <http://www.lib.pdx.edu/systems/eresources/subjects.php>. Try EI Compendex (<http://www.ei.org/ev2/ev2.home>) and Lexis-Nexis. Note that access to these databases is free for PSU students using your Odin login.

Format

Minimum requirements for the special topics presentation are as follows (essentially based on Transportation Research Board (TRB) procedures with a few exceptions):

- See TRB presentation guidelines: <http://www.trb.org/Guidelines/AudiovisualAids.pdf>
- Plan to speak for about 20 minutes, so you should prepare a highly professional style Powerpoint presentation.
- All exhibits, photos, graphics, tables, figures, and charts, should be labeled, and sources cited.
- Presentation should be given in your own words.
- Cite all sources of any facts or opinions if they are not your own.
- Include a title page, outline, conclusion, recommendations and an appendix containing a list of specific references cited in your presentation.
- Use TRB format for listing references: <http://www.trb.org/Guidelines/Authors.pdf>
- Avoid jargon, acronyms, and use of personal pronouns in your presentation.
- Each student must prepare an individual presentation.
- Upload presentation to class wiki prior to your presentation, and provide a handout (notes format) for each student and the instructor.

References

- The reference list shall include only those references cited in the presentation; number them in the reference list in the order they are first cited in the presentation.
- Denote a reference at the appropriate place in the presentation by an underlined or italic arabic numeral in parentheses, e.g., (2).
- Do not repeat a reference in the list and do not use *ibid.*, *idem*, *op. cit.*, or *loc. cit.* If a reference is cited more than one time in the text, repeat the number first assigned to the reference.
- Do not use footnotes to the text. Incorporate such notes within the text.

The following are some samples of the basic style for references (see the TRB website for other reference format information at www.nas.edu/trb):

Sample Reference Style for TRB Publications:

V. Zahavi and J.M. Ryan. Stability of Travel Over Time. In *Transportation Research Record 750*, TRB, National Research Council, Washington, D.C., 1980, pp. 70-75.

Sample Reference Style for Book:

D. Shinar. *Psychology on the Road: The Human Factor in Traffic Safety*. John Wiley and Sons, Inc., New York, 1978.

Sample Reference Style for Periodical:

J.K. Jolliffe and T.P. Hutchinson. A Behavioral Explanation of the Association Between Bus and Passenger Arrivals at a Bus Stop (in Japanese). *Transportation Science*, Vol. 9, No. 3, May 1975, pp. 248-282.

Sample Reference Style for Government Report:

B.J. Dempsey. *Climatic Effects of Airport Pavement Systems: State of the Art*. Report DOT2DRD-75-196. FHWA, U.S. Department of Transportation, 1976.

Presentation Evaluation

You will be evaluated on your presentation as follows:

- Introduction/Background - 10 %
- Objectives - 10 %
- Body and Quality of Research Tools Used - 20 %
- Conclusions/Recommendations/Perspective - 20 %
- Language/Style - 10%
- Overall Impression - 10%
- Speaking Style – 20%

Presentation

Attendance

All students are required to attend all paper presentations. You will be graded on your presentation. This should be looked upon as an opportunity to gain experience making a professional presentation in a supportive environment, among your peers.

Delivery

The primary contributors to an effective presentation are (a) technical content, (b) visual aids, and (c) skills of the speaker. Remember that a presentation may (should) differ from the printed paper and that the presentation gives the author an opportunity to discuss and emphasize highlights of the work, which may not be possible to do in the printed version. It is recommended that you think towards structuring your presentation as follows:

- Title
- Objectives
- Outline of Presentation
- Methodology
- Body
- Summary
- Conclusion
- Perspectives

Do not read the paper or presentation. Practice to become completely familiar with your presentation so that you can speak from memory or notes. Concentrate on your delivery. Speak clearly and at a pace somewhat slower than normal conversation. Avoid a monotone. Can you be heard throughout the room, and are you facing your audience, instead of looking at the visual aids?

Timing

Your presentation will be limited in time (to be determined). Most people are surprised when their time is up! It is very helpful if you practice your talk beforehand, keeping track of elapsed time. Recognize that actual presentations usually take longer than rehearsals. Help your audience by not exceeding your allotted speaking time.

Visual Aids

Visual aids are always effective tools for communicating your ideas quickly, and therefore are recommended. An overhead projector will be available. Do not consider using the white/chalk board as a substitute for visual aids. Please do not use all text visuals that convey no additional information to the audience. A maximum of one or two visuals should be used per minute of presentation. The instructor will be happy to assist you in the development of visual aids.

Possible Presentation Topics

I suggest you first explore some web resources, especially:

US Dept. of Transportation: <http://www.its.dot.gov>
ITS America: www.itsa.org
National Transportation Operations Coalition: <http://www.ntoctalks.com/index.php>
ITS What have we learned: . http://www.itsdocs.fhwa.dot.gov/jpodocs/repts_te/@9w01!.pdf
Oregon Department of Transportation..... <http://www.oregon.gov/ODOT/HWY/ITS/>
ODOT TripCheck: <http://www.tripcheck.com/>
ODOT Region 1: <http://www.oregon.gov/ODOT/HWY/REGION1/>
Benefit Cost Data: <http://www.benefitcost.its.dot.gov/>
CITE Modules: <http://www.courses.umd.edu/>
PATH Database:..... <http://www4.nationalacademies.org/trb/tris.nsf/web/path>
ITS Decision: <http://www.calccit.org/itsdecision/>
U.C. Berkeley PATH Program <http://www.path.berkeley.edu>
PSU ITS Lab..... <http://www.its.pdx.edu>

Also, you can sign up for a free email newsletter, The Transportation Communications Newsletter, published electronically Monday through Friday. For a free subscription send an e-mail message to: transport-communications-subscribe@yahoogroups.com

See if you can find a subject that interests you and perform some preliminary research. I have listed several possible topics for your consideration:

- Statistical analysis of freeway travel time data
- Analyze impact of variable message signs on traffic parameters
- Smart carsharing
- PSU advanced parking management literature review/proposal/analysis
- NGSIM data analysis (freeway or arterial)
- Oregon RWIS data analysis
- Validation of loop data using video
- Optimal detector spacing/placement
- Traffic data fusion from multiple sources.
- Arterial data analysis using City of Portland traffic signal data (Barbur or 82nd Ave)
- Analysis of Oregon 511 data.
- Update on Oregon ITS programs and projects.
- Use results of statewide crash analysis to recommend curve and/or ice warning systems.
- Identification and analysis of Portland freeway bottlenecks
- Data collection experiment in arterial corridor and comparison with TriMet Bus Dispatch System Data for arterial performance measurement.
- Generate traffic model using archived ITS data
- Green Benefits of ITS

- Congestion Pie
- Transit boardings relation to weather
- Taxi data
- Speed variance by lane
- Analyze Columbus, OH individual vehicle data
- Create ITS Lab Video
- 95th Percentile Travel Time system for Portland Freeways
- Smart freeway travel time estimation (more than one detector)
- Orange County California I-405 Bottleneck Analysis
- Impacts of data aggregation and measurement errors
- [Heydecker paper](#) replicate using Portland data [[ppt](#)]
- Use ITS data to further understand traffic model uncertainty propagation
- Travel time reliability analysis using real traffic data
- Continuing analysis of I-5/Barbur Blvd. travel time data from freeway, bus probes and arterial buses with focus on traffic signal data.
- Continuing analysis of variable speed limit system on German Autobahn.
- Summary and continuing an improved statistical comparison of freeway sensor data with probe vehicle data on a German Autobahn.
- Continuing travel time study on Portland freeway corridors: analysis of probe vehicle data (experimental) with loop detector data.
- Statistical analysis of weigh in motion data.
- Examination and diagnosis/debugging of results of loop detector algorithm (Nihan and Wang) to estimate vehicle classification and comparison to loop and video data.
- Application of Synchro simulation package.
- Application of VISSIM simulation package.
- Application of Paramics simulation package.
- Traffic signal coordination before/after study using GPS data
- Application of CORSIM simulation model.
- Application of PRUEVIN Evaluation process.
- Intelligent Transportation Systems Deployment Analysis System (IDAS)
- Application of TSIS model.
- ITS Data Warehousing state of the art
- ATIS Market Analysis
- Analysis of Incident Response data (COMET)
- Performance measurement and evaluation (e.g., what is congestion?)
- Rural ITS and congestion relief
- ITS Planning for Oregon's metro areas: Portland, Salem, Eugene, Medford, Bend, etc.
- Two-lane road ITS and safety issues
- Mountain pass ITS/safety topics
- RWIS data
- ATR Data comparison with Loop Detector Station and video surveillance

Computer and Email Accounts

All engineering students should activate their engineering computer account (go to the CadLab in EB 325) which will allow them to use engineering computer labs and email. You should activate it *before* the day you need it. If you encounter problems with this account, see the lab attendant, or email: support@cecs.pdx.edu. Please note: the CEE Department regularly sends course announcements, job information, etc. to students' CECS accounts, so if you do not check it regularly, we recommend forwarding your CECS e-mail to whatever e-mail address you use.

Ethics and Professionalism

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

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

Student Groups and Professional Organizations

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

- American Society of Civil Engineers Student Group (ASCE): <http://www.asce.pdx.edu>
- Students in Transportation Engineering and Planning (STEP) and Institute of Transportation Engineers Student Chapter (ITE): <http://www.its.pdx.edu/ite/>

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

- [Women's Transportation Seminar](#) Portland Chapter
- American Society of Civil Engineers (ASCE) Oregon Section: www.asceor.org
- Institute of Transportation Engineers (ITE) Oregon Section: www.oregonite.org
- Society of Women Engineers (SWE) Columbia River Section - <http://www.swe-columbia-river.org>
- Structural Engineers Association of Oregon (SEAO): www.seao.org

Resources

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

- CE Website (includes program info, job listings, etc.): <http://www.cee.pdx.edu>
- CE Website Job Listings: http://www.ce.pdx.edu/ce_jobs.shtml
- Career Center: <http://www.career.pdx.edu/>
- Academic Advising: <http://www.pdx.edu/advising>
- Center for Student Health & Counseling: <http://www.shac.pdx.edu/>
- The Writing Center: <http://www.writingcenter.pdx.edu/>
- PSU Disability Resource Center: 435 Smith Memorial Union
- Portland CE firms and agencies: <http://web.pdx.edu/~bertini/resources.html>

Many students have internships, summer jobs, etc., so if you have any questions about how to begin the employment search please let me know.

Note: The PSU Disability Resource Center is available to help students with academic accommodations. If you are a student who has need for test-taking, note-taking or other assistance, please visit the DRC and notify the instructor at the beginning of the term.

Campus Safety

The University considers student safety paramount. The Campus Public Safety Office is open 24 hours a day to assist with personal safety, crime prevention and security escort services. Call 503-725-4407 for more information. For Campus emergencies call 503-725-4404 (from campus phones dial 5-4404). To dial 911 from a campus phone, you must dial 9-911.