CALIFORNIA POLYTECHNIC STATE UNIVERSITY
Civil and Environmental Engineering

CE 528: Transportation Analysis, Fall 2005
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Course Objectives: To learn methods for analyzing and evaluating large engineering systems, focusing on transportation systems. These methods include systems analysis, alternatives evaluation, advanced engineering economics, benefit-cost analysis, production theory and modeling, cost and benefit modeling, economic base modeling, pricing theory, optimization, risk analysis, and decision analysis. The course addresses transportation impact assessment and quantifying consequences of transportation projects for users, non-users, and regional economies. The lab stresses computer analysis of transportation impacts and their economic evaluation.

SCHEDULE OF TOPICS AND ACTIVITIES

1) Intro. to decision analysis, modeling, evaluation (Read: 1.all, 8.1-8.2, 16.all, 8.3-8.4, 8.6-8.7)
   - ❖ Homework: 1.6, 1.12, 8.5, 8.7, 8.18, 16.5, 16.7 (**Due:** Thursday, October 13 – w/ section 2)
   - ❖ Seminar Topics:
     - (10/4) Impact Analysis of ITS Projects: Discuss IDAS (http://idas.camsys.com/) and SCRITS (http://www.fhwa.dot.gov/steam/scrits.htm) (2 persons)
     - (10/4) Simmons, Matthew R. Revisiting *The Limits to Growth*: Could the Club of Rome Have Been Correct, After All? Energy White Paper. October 2000. (http://greatchange.org/ov-simmons,club_of_rome_revisted.pdf) (1 person)
2) Financial math and issues in engineering economic analysis (Read: 4.all, 5.all, 7.all)
   - ❖ Homework: 4.7b, 8.11, 5.1, 5.8, 5.11b (**Due:** Thursday, October 13)
   - ❖ Seminar Topics:
     - (10/11) Li, J., D. Gillen, and J. Dahlgren. "Benefit-Cost Evaluation of the Electronic Toll Collection System: A Comprehensive Framework and Application". *Transportation Research Record 1659*, TRB, Washington, D.C., 1999, pp. 31-38. On-line summary at: http://www.dot.ca.gov/hq/tpp/offices/ote/Benefit_Cost/case_studies/index.html (1 person)
     - (10/11) DJM Consulting & ECONorthwest. *Benefit-Cost Analysis of the Proposed Monorail Green Line*. Elevated Transportation Co., Seattle, WA. Aug. 2002. On-line at: http://kkriz.lunarpages.com/Files/Teaching/SOAH01193/BCA_Report_Final_revised.pdf. And: http://www.dot.ca.gov/hq/tpp/offices/ote/Benefit_Cost/case_studies/index.html. (1 person)
     - (10/11) Asano, M., S. Tanabe, F. Hara, and S. Yokoyama. "Economic Evaluation of Banning Studded Tires Because of Environmental Impact." *Transportation Research Record: Journal of the Transportation Research Board*, No. 1794, TRB, National Research Council, Washington D.C., 2002, pp. 84-93. On-line summary at: http://www.dot.ca.gov/hq/tpp/offices/ote/Benefit_Cost/case_studies/index.html (1 person)

- (10/18) Brand, D., T. E. Parody, J. E. Orban, and V. J. Brown. "Benefit-Cost Analysis of the Commercial Vehicle Information Systems and Networks Program." *Transportation Research Record: Journal of the Transportation Research Board, No. 1800*, TRB, National Research Council, Washington, D.C., 2002. pp. 35-43. On-line summary at: http://www.dot.ca.gov/hq/tpp/offices/ote/Benefit_Cost/case_studies/index.html (1 person)
- (10/18) Sullivan, E.C. and M. Burris. Benefit-Cost Analysis of Variable Pricing Projects: SR-91 Express Lanes & Burris, M. and E.C. Sullivan. Benefit-Cost Analysis of Variable Pricing Projects: QuickRide HOT Lanes. Journal of Transportation Engineering. American Society of Civil Engineers, (in press) 2006. (2 persons – compare/contrast approaches) (ask for copy)

3) Production and cost modeling (Read: 3.1-3.2, 18.7, 3.3-3.5, 12.all)

❖ Homework: 3.6, 3.9, 3.11, 3.12, 18.23, 12.9, 12.15 (**Due:** Thursday, November 10)

❖ Seminar Topics:

- (10/25) The World Bank. Design and Appraisal of Rural Transport Infrastructure. On-line at: http://www.worldbank.org/html/fpd/transport/rural_tr/des&appr.htm. (Give overview with emphasis on the section about “HDM III.”) (1 person)
- (10/25) Jong, Jyh-Cherng, and Paul Schonfeld. Cost Functions for Optimizing Highway Alignments. Transportation Research Board, Record 1659. Washington DC. 1999. (1 person)
- (10/25) Miller, Jon R. et al. Estimating Important Transportation-Related Regional Economic Relationships in Bexar County, Texas. VIA Metropolitan Transit. San Antonio TX. October 1999. On-line at: http://www.vtpi.org/modeshft.pdf (1 person)

4) Pricing concepts and applications

❖ Seminar Topics:

- (11/1) Perez, Benjamin G. and Gian-Claudia Sciara. A Guide for HOT-Lane Development. PB Consult for U.S. Federal Highway Administration. Report FHWA-OP-03-009. March 2003. (2 persons) Person 1: Chaps. 1, 2, 4; Person 2: 7.3 & 7.4 (contrast the projects) phttp://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13668.html
- (11/1) Poole, Robert W. Jr. and C. Kenneth Orski. HOT Networks: A New Plan for Congestion Relief and Better Transit. Reason Foundation, Policy Study 305. February 2003. On-line at: http://www.reason.org/policystudiesbysubject.shtml#transportation. (1 person)
- (11/1) Burris, Mark, et al. Observed Traffic Pattern Changes Due to Variable Tolls. Transportation Research Board, Record 1732. Washington DC. 2000. (1 person)
- (11/8) Evans, John E. (ed.) Traveler Response to Transportation System Changes (Chapter 14 - Road Value Pricing). TCRP Report 95. Transportation Research Board. Washington DC. 2003. (2 persons)
- (11/8) Litman, Todd A. Pay-As-You-Drive Pricing For Insurance Affordability. Victoria Transport Policy Institute. Victoria BC. May 2004. On-line at: http://www.vtpi.org/payd_aff.pdf (1 person)

- (11/15) Oregon Road User Fee Pilot Program. On-line at: http://www.oregon.gov/ODOT/HWY/OIPP/mileage.shtml (1 person)
- (11/15) Nash, Chris, Bryan Matthews, et al. Charges for Heavy Goods Vehicles: EU Policy and Key National Developments. Imprint-Europe. October 2003. On-line at: http://www.imprint-eu.org/public/Themaccess.htm#mod2. (1 person)
- (11/15) Balmer, Ueli. Practice and Experience with Implementing Transport Pricing Reform in Heavy Goods Transport in Switzerland. Imprint-Europe. May 2003. On-line at: http://www.imprint-eu.org/public/Papers/IMPRINT4_balmer.pdf. (1 person)
- (11/22) Poole, Robert W. Jr., and Peter Samuel. Corridors for Toll Truckways: Suggested Locations for Pilot Projects. Reason Foundation, Policy Study 316. February 2004. On-line at: http://www.reason.org/policystudiesbysubject.shtml#transportation. (1 person)

5) Benefit estimation and modeling (Read: 2.1-2.4, 8.5)
   - ❖ Homework: 2.12, 8.5, 8.9, and TBA (**Due:** Thursday, December 1 – w/ sections 6 & 7)
   - ❖ Seminar Topics:
     - (11/22) Economic Development Research Group. California High Speed Train Program EIR/EIS: Economic Growth and Related Impacts. Boston MA, 2004. On-line at: http://www.edrgroup.com/edr1/library/lib_trans_bus/P097-cal-high-speed.shtml (Put emphasis on part about economic growth and development.) (1 person)
     - (11/22) Economic Development Research Group, KKO & Asso. Economic Benefits of Amtrak Downeaster Service. Maine Dept. of Transportation. Feb. 2005. On-line at: http://www.edrgroup.com/edr1/library/lib_trans_bus/P128-Maine-Downeaster-Passenger-Rail.shtml. (1 person, focus on Ch. 5)
     - (11/29) HNTB Corporation, et al. Virginia Public-Use Airport Economic Impact Study. Virginia Dept. of Aviation. April 2004. On-line at: http://www.edrgroup.com/edr1/library/lib_trans_air/P084-virginia-statewide-airport.shtml (1 person, focus on methodology)
     - (11/29) Vary, D. and G. Weisbrod. A Quantitative Analysis of Public Transportation's Economic Impact. American Public Transit Association. Washington DC. October 1999. On-line at: http://www.edrgroup.com/edr1/library/lib_trans_bus/P024-public-transportation-APTA.shtml. (1 person, focus on Exec. Summ., Ch. 1 & 6)
     - (11/29) Litman, Todd, and Felix Laube. Automobile Dependency and Economic Development. Victoria Transport Policy Institute. Victoria BC. August 2002. On-line at: http://www.vtpi.org/ecodev.pdf (1 person)
6) Optimization (Read: 18.1-18.2, 18.5-18.6)
   - ❖ Homework: TBA (**Due:** Thursday, December 1 – combined w/ sections 5 & 7)
7) Decision analysis methods, risk and uncertainty (Read: 13.3-13.4, 14.all, 15.all)
   - ❖ Homework: 13.14a, 14.3, 14.7, 14.23, 15.9 (**Due:** Thursday, December 1)
8) REVIEW & FINAL EXAM

Required Texts:

1) Fabrycky, W.J., G.J. Thuesen, D. Verma. *Economic Decision Analysis*. 3rd Edition. Prentice-Hall; Upper Saddle River, New Jersey. 1998. (Required readings and homework problems all come from this text.)
2) CE 528 Lecture Outlines (Available at El Corral Textbooks, UU.)

Other Pertinent Resources:

1) Economic Analysis Primer: FHWA Asset Management. US Department of Transportation, Federal Highway Administration, Office of Asset Management, FHWA-IF-03-032, 2003. On-line at: http://www.fhwa.dot.gov/infrastructure/asstmgmt/primer.htm. Accessed Sept. 2004.
2) Weisbrod, Glen, and Burton Weisbrod. Assessing the Economic Impact of Transportation Projects. Transportation Research Board, Circular 477. Washington DC. October 1997. On-line at: http://www.edrgroup.com/edr1/library/lib_guides_special/assessing-the-economic-im.shtml. Accessed September 2004.
3) Economic Development Research Group. Economic Impact Analysis – Models, Guides. At: http://www.edrgroup.com/edr1/library/. Accessed Sept. 2004.
4) D. Lewis. Primer on Transportation, Productivity and Economic Development, Transportation Research Board. National Cooperative Highway Research Program (NCHRP) Report 342. Washington DC. August 1996.
5) Multimodal Evaluation of Passenger Transportation. NCHRP Synthesis of Practice 201. Transportation Research Board. National Academy Press. Washington DC. 1994.
6) Meyer, M.D. and Miller, E.J., Urban Transportation Planning: A Decision-Oriented Approach. 2nd Edition. McGraw-Hill, New York, 2001.

EVALUATION OF STUDENT WORK

50 points – Five lab reports (10 points each)
15 points – Checkoff on three homework assignments – Note: You will get full credit (5 points each) for handing in homework that appears complete and a credible effort.
15 points – Final exam (during finals week) – Note: you may bring a single 8½x11 piece of paper containing any information you desire (both sides). The final exam will be based on questions adapted from homework assignments, lab reports, and the lecture notes on pricing.
20 points – Seminar presentation (20 minutes per student) – Please email your instructor **before Wednesday night (Sept. 21)** and list your 1st, 2nd, and 3rd choice topics. Also identify with whom you would like to partner in the case of 2-person topics. Your presentation should include substantial technical detail. You should use high quality visual aids, copies of which must be photocopied and distributed to the audience.

Note: Homeworks and lab reports are due on the dates specified. Late work will be accepted, but grades for unexcused late assignments will be reduced 10% for each week or partial week they are late. Note that late and (especially) missing assignments can seriously damage your grade.

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TENTATIVE SCHEDULE OF LABS

1. Analysis of Engineering Economy
2. Evaluation of Alternative Highway Improvement Projects
3. Evaluation of Alternative Road Design and Maintenance Standards
4. Economic Impact of a Transportation Improvement Program
5. Optimizing Transportation Operations

Labs will usually take two weeks each. Work may be performed individually or in teams of no more than two; however, individual lab reports are required in all cases. Reports will be evaluated on both technical content and quality of presentation, including English composition. While details obviously vary, lab reports should usually follow the general outline presented below:

- Executive Summary - Very briefly identify the nature and motivation of the study, the general features of the methodology, and your principal findings and conclusions (3-4 paragraphs).
- Background - Describe in a more detail the nature of the study, the theoretic foundations for the analysis, the technical approach, and any other pertinent background (less than a page).
- Results - Present your results in easy to follow form, using tables and charts as appropriate. Although key quantitative results should appear in the body of the report, often in summary tables and/or figures, detailed work sheets and voluminous results which would impede the reader's progress in following the work should be placed in appendices or omitted altogether (a page or two, plus key tables/figures).
- Key conclusions and recommendations and their justification (about half a page).
- Appendices (if needed). Here's where you put voluminous data tables, other displays, and lengthy calculations, the details of which would be of little interest to your intended reader. Note that summary tables and key displays should be given meaningful titles and imbedded in the report body, immediately after being first referenced in the text.

ORGANIZATIONAL QUESTIONNAIRE

1. Your name:

2. Have you taken IE 314 or any other class dealing with discounting and engineering economic analysis? (If not IE 314, please specify)

3. Have you taken ECON 211 (Principles of Economics) or something equivalent?

4. Have you taken any other classes in economics besides ECON 211? If so, please identify and (if not current Poly courses) briefly describe.

5. Have you had any experience with solving optimization problems through Mathematical Programming? If so, please describe.

6. In addition to CE 221, what transportation classes have you taken, or are now taking?

7. Based on the catalog description or other sources, please list any specific topics you hope this course will emphasize. In short, what motivated you to take this course? What can your instructor do to make this course most useful for you?