

CEE 6651: INFRASTRUCTURE SYSTEMS

School of Civil & Environmental Engineering, Georgia Institute of Technology
Fall 2006

COURSE SYLLABUS

Instructor: Dr. Adjo Amekudzi
Credits: 3 Hours
Course Location: SEB 316, W: 3:05-5:55P

Office Hours: Mon, Thur: 3-4:30P/By apt.
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COURSE DESCRIPTION

This course reviews the status of civil infrastructure, and analytical methods, tools, data, technologies, policies and economic/financial frameworks for managing infrastructure systems and facilities as assets. Progressively, performance-driven and value-based approaches are being adapted to plan, design, operate, maintain and renew infrastructure. As asset management implementation evolves, there is a growing collection of principles, methodologies, models and tools that can be used to assist in strategic planning and more efficient use of resources in infrastructure decision making. The course reviews infrastructure needs assessment approaches, condition assessment methods, deterioration models, project evaluation methods, optimization and ranking methods, asset valuation and depreciation methods, infrastructure and asset management systems; and policies, rules and regulations affecting infrastructure management. Transportation is used as the main case study in the course; however the principles and methods taught are applicable to various types of infrastructure facilities and systems.

COURSE OUTCOMES

Upon completing this course, students will demonstrate their understanding of the issues involved in managing infrastructure facilities and systems as assets, the methods, tools and other resources available for this task, and the evolving institutional context for implementing asset management programs in infrastructure agencies. They will be able to complete a conceptual design of a management system for a selected facility and system, and conduct evaluations to determine the relative effectiveness of various management systems. Students will also demonstrate an understanding of the basic principles of engineering communications: written, oral and visual, through their term papers and oral presentations.

COURSE READER

The course reader is a compilation of articles and book chapters on infrastructure and asset management. The reader is required for the course and is available at the Engineer's Bookstore (748 Marietta Street). Additional material will be provided to supplement the reader as necessary.

COURSE EVALUATION

	Standard (without Final)	Alternative (with Final)
Homework	40%	40%
Midterm	30%	15%
Term Paper	30%	30%
Final	0%	15%

COURSE OUTLINE (REVISED)

Week	Date	Topics	Assigned	Due
1	8/23	Course Overview; Status of Infrastructure and Asset Management; Infrastructure Needs Assessment, ASCE: National/State/Local Infrastructure Report Cards; Government Performance Project, USDOT Condition and Performance Reports	HW1 Term Paper	
2	8/30	Needs Assessment/Review of Readings	HW2	
3	9/6	Condition Assessment: Data Needs for Infrastructure Management; Data Collection Technologies; Pavement Condition Index Method (USACE); Bridge Health Index Method (CalTrans); BUILDER EMS (USACE)		HW1 (10%)
4	9/13	Deterioration Modeling: empirical, mechanistic, deterministic, stochastic, project and network-level models	HW3	HW2 (10%)
5	9/20	Engineering Economic Analysis: Present worth analysis, EUAC, Effective interest rates, Perpetual life, Arithmetic and Geometric progressions, Inflation	HW4	HW3 (5%)
6	9/27	Project Evaluation: Net Present Value, Benefit/Cost Analysis, Internal Rate of Return, Spreadsheet Financial Functions		HW4 (5%) Paper Topic/ Bibliography
7	10/4	Midterm		Midterm (30%)
8	10/11	Engineering Communication: Dr. Lisa Rosenstein		
9	10/18	Priority Assessment: Ranking Methods		Literature Review Synthesis (2.5%)
10	10/25	Priority Assessment: Mathematical Optimization	HW5	Abstract and Outline (2.5%)
11	11/1	Infrastructure and Asset Management Systems: HERS, PONTIS, ASSET Manager NT and PT, GDOT Pavement Management System; Asset Valuation and Depreciation; Asset Management Rules/Laws: GASB 34; MI and VT Laws; Infrastructure Sustainability		HW5 (5%)
12	11/8	International Best Practices in Transportation Asset Management	HW6	Draft Paper (5%)
13	11/15	Domestic Best Practices in Transportation Asset Management Dr. Michael Meyer		HW6 (5%)
14	11/22	NO CLASS		
15	11/29	Project Presentations		Project Presentation (10%)
16	12/6	Project Presentations		Final Paper (10%)
17	12/13	Final Exam (Optional)		

Updated: 10/18/06

COURSE CONDUCT

This Georgia Tech Honor Code is the standard of conduct for this course. The Honor Code is available at <http://www.honor.gatech.edu/>. Discussion and interaction are important in this course. Discussion is encouraged on homework assignments and group projects. However, each student is expected to turn in a unique solution. When computer analysis is used, each student is expected to complete the analysis independently even when a group effort made to explore solution methods. Discussion and collaboration on in-class and take-home exams is unacceptable. Plagiarism is unacceptable. To understand what constitutes plagiarism, review the following website produced by the Writing Tutorial Services at Indiana University, Bloomington, IN: www.indiana.edu/~wts/wts/plagiarism.html. Breaches of academic honesty (plagiarism or cheating) will be dealt with in accordance with university policy.

ADDITIONAL RESOURCES

<i>Journals</i>
<ul style="list-style-type: none">• Journal of Infrastructure Systems (ASCE)• Public Works Management and Policy (APWA)• Transportation Research Record: Journal of the Transportation Research Board (TRB)
<i>Websites</i>
<ul style="list-style-type: none">• The Asset Management Source for North America: http://www.amsna.org/• Infrastructure Report Cards, American Society of Civil Engineers (ASCE): www.asce.org• Government Performance Project: http://results.gpponline.org/• Conditions and Performance Report for Highways, Bridges and Transit (2002): http://www.fhwa.dot.gov/policy/2002cpr/intro.htm• American Public Works Association (APWA): www.pubworks.org/• ASCE Infrastructure Systems Committee: www.asce.org• Bureau of Transportation Statistics: http://www.bts.org• Center for Infrastructure and Transportation Studies -- Rensselaer Polytechnic Institute: http://www.rpi.edu/dept/cits/index.htm• FHWA/AASHTO Asset Management Community of Practice/ Transportation Research Board Asset Management Committee: http://assetmanagement.transportation.org• Infrastructure Technology Institute -- Northwestern University: http://iti.acns.nwu.edu/• Institute of Civil Infrastructure Systems (ICIS) -- New York University: http://www.icisnyu.org/• Midwest Regional University Transportation Center: http://www.mrutc.org/• Civil Infrastructure Research Center – University of Puerto Rico – http://circweb.upr.clu.edu/• National Guide for Municipal Infrastructure, Canada -- http://www.infraguide.ca/• National Asset Management Steering Group, New Zealand: http://www.nams.org.nz/Home

The instructor reserves the right to modify the course syllabus as necessary. Any changes will be announced in class. Updated: 10/18/06

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READING LIST

	<p>Status of Civil Infrastructure, Infrastructure Management, Infrastructure Needs Assessment</p> <p><u>Status of Infrastructure</u></p> <p>* Hudson, Ronald W., Haas, Ralph and Waheed Uddin (1997) Infrastructure Management, McGraw-Hill. Chp. 1: The Big Picture: 3-28</p> <p>* ASCE Report Card</p> <p>Status and Condition of the Nation’s Highways Bridges and Transit, 2002. http://www.fhwa.dot.gov/policy/2002cpr/</p> <p>* Dunker, Kenneth and Basile Rabat, “Assessing Infrastructure Deficiencies: The Case of Highway Bridges,” <i>ASCE Journal of Infrastructure Systems</i>, Vol. 1, No. 2, June 1995: 100 - 119.</p> <p><u>Needs Assessment</u></p> <p>* Hudson, Ronald W., Haas, Ralph and Waheed Uddin (1997) <i>Infrastructure Management</i>, McGraw-Hill. Chp. 2: Framework for Infrastructure Management: 3-28; and Chp. 3: Planning, Needs Assessment and Performance Indicators: 45-60.</p> <p>* National Council on Public Works Improvement (NCPWI), The Nation’s Public Works, Defining the Issues, Washington, D.C., 1986. Chp. 2: Needs Studies: 7-21.</p> <p>* Fragile Foundations: A Report on America’s Public Works. National Council on Public Works Improvement, February 1988.</p> <p><u>Infrastructure and Economic Development</u></p> <p>Kessides, Christine and Gregory Ingram. Infrastructure’s Impact on Development: Lessons from WDR 1994. <i>ASCE Journal of Infrastructure Systems</i>, Vol. 1, No. 1, March 1995: 16-31.</p> <p>* Weir, Fred (2001) Russia Raises Alarm over Crumbling Infrastructure, <i>Christian Science Monitor</i>, February 15.</p>
	<p>Condition Assessment</p> <p>* Haas, Ralph ; Hudson, Ronald W., and John Zaniewski (1994) Modern Pavement Management, Krieger Publishing Company. Chp. 6: Review of Pavement Management Data Needs: 61-68, Chp. 7: Inventory Data Needs: 69-75.</p> <p>* Shahin, M. Y. (1994) Pavement Management for Airports, Roads and Parking Lots, Kluwer Academic Publishers. Chp. 3: Pavement Distress Survey and Rating Procedures: 15-38.</p> <p>* Shepard, Richard W., and Michael B. Johnson (2001) California Bridge Health Index, <i>TR News</i>, pp. 6-9.</p>
	<p>Deterioration Models, Infrastructure Performance, Performance Prediction</p> <p>* American Association of State Highway and Transportation Officials (2001) Pavement Management Guide. Chp. 7: Predicting Deterioration: 135-158.</p> <p>* Hudson R., Haas, R. and Zaniewski J (1994) Modern Pavement Management, Krieger. Chp. 16: Prediction Models for Pavement Deterioration: 193-201.</p>

*	<p>Fundamentals of Engineering Economy</p> <p>Blank, L, and A. Tarquin (2002), Engineering Economy, McGraw-Hill. Chp 1: Foundations of Engineering Economy</p>
*	<p>Project Evaluation</p> <p>Blank, L, and A. Tarquin (2002), Engineering Economy, McGraw-Hill. Chp 9: Benefit/Cost Analysis and Public Sector Economics</p>
*	<p>Priority Assessment</p> <p>American Association of State Highway and Transportation Officials (2001), Pavement Management Guide. Chp 9: Selection of Candidate Sections when Funds are Constrained: 173-193.</p> <p>Hudson R., Haas, R. and Zaniewski J (1994) Modern Pavement Management, Krieger. Chp. 19: Priority Programming of Rehabilitation and Maintenance: 225-239.</p> <p>Golabi, Kamal and Ram Kulkarni (1983) Arizona’s Statewide Pavement Management System, ASCE Magazine, March: 43-47.</p> <p>Davis, C. F., and Van Dine, P. (1988) Linear Programming Model for Pavement Management, Transportation Research Record 1200, Transportation Research Board: 71-75.</p> <p>Hagquist, Ronald F. (2001) The Potential for Improved Project Selection in Departments of Transportation, <i>Proceedings of the 2001 Annual Meeting of the Transportation Research Board (CD ROM)</i></p>
*	<p>Asset Management, ISTEA Management Systems, Valuation and Depreciation</p> <p>United States Department of Transportation (1999) Asset Management Primer</p> <p>United States Department of Transportation (2000) Primer: GASB 34</p> <p>National Cooperative Highway Research Program (2002) Transportation Asset Management Guide</p> <p>American Public Works Association (2002) Getting the Most out of Your Infrastructure Assets, A Guide to Using Infrastructure Asset Management Systems, Report prepared by Andrew C. Lemer, Ph.D.</p> <p>Executive Summary, International Scan on Asset Management: Alberta, Australia, England, New Zealand, April 2005</p>
*	<p>Infrastructure, the Environment and Sustainable Development</p> <p>Pearce, A. R. and Vanegas, J. A. (2002). “Defining Sustainability for Built Environment Systems,” <i>International Journal of Environmental Technology and Management</i>, Special Issue on Sustainability and the Built Environment, 2(1): 94-113.</p> <p>Jeon, C.M., and A. Amekudzi. (2005). Addressing Sustainability in Transportation Systems: Definitions, Indicators and Metrics. <i>Journal of Infrastructure Systems, American Society of Civil Engineers</i>, Vol. 11, No. 10, March 2005.</p> <p>Rijsberman, M. A. and van de Ven, F. H. M. (2000). “Different Approaches to Assessment of Design and Management of Sustainable Urban Water Systems.” <i>Environmental Impact Assessment Review</i>, Vol. 20, No 3, 333-345.</p>
*	<p>Megacities and Megaprojects</p> <p>Zwingle, Erla, Cities -- Challenges for Humanity, <i>National Geographic Magazine</i>, November 2002.</p> <p>Capka, Richard J., Megaprojects -- They are a Different Breed, <i>Public Roads</i>, July/August 2004.</p>