

CEE 4803C: Infrastructure System Management - Fall 2016

Time: Tuesdays and Thursdays (1:35 - 2:55PM)
Class Room: Sustainable Education Building (SEB) 121
Credits: 3 Hours (3-0-3), technical elective in CEE

Instructors

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Course Description

The American Society of Civil Engineers (ASCE) recently graded the Nation's infrastructure (such as bridges, dams, sewers, pipelines, and port systems) as a D+ (asce.org). Although this is an improvement from the D rating 4 years previously, it is still estimated that an additional \$3.6 trillion of investment is required by 2020 to meet the existing forecasted needs. ASCE has also recognized that beyond funding, changes in management of infrastructure assets are necessary. As such, they are supporting a Grand Challenge to improve the life-cycle of infrastructure assets by 50% by 2025. This initiative includes improving the long-term performance of assets and optimizing investment as related to infrastructure. Proper management of infrastructure assets can lead to advances in these areas, and therefore awareness of best practices and tools in infrastructure asset management is essential for future leaders involved in the infrastructure industry.

This course will cover basic and emerging infrastructure asset management concepts that encompass any physical infrastructure asset, such as found in the class text, ISO 55001 (International Organization for Standardization) and other national and international asset management initiatives. Due to the limitation of time and to balance breadth and depth, more in-depth discussions on transportation infrastructure systems are presented in this course to show hands-on the details of how infrastructure system management works with an integrated approach. Pavement and bridge systems, crucial transportation infrastructure assets supporting our basic societal functions and economic prosperity, will be used in this course to illustrate the importance of quality asset data and how IT and sensing technologies can be applied throughout the entire life-cycle activities of a pavement system, including planning, design, construction, operation, maintenance, and rehabilitation. A real-world, large-scale IT-based infrastructure management system developed by the instructors and successfully implemented by the Georgia Department of Transportation will be presented. To enrich students' knowledge, national experts from Federal and State highway agencies will be invited to give talks in this class.

This course will present a broad and integrated approach to better manage infrastructure assets, including infrastructure asset management, preventive maintenance, and the use of IT technologies, sensing technologies, and mathematical programming. Infrastructure/asset management concepts incorporate both engineering and economic analyses over the entire life of an infrastructure asset, as well as incorporate financial and risk management concepts. To reinforce the student's learning they will also be involved in developing real world maintenance and rehabilitation (M&R) plans for infrastructure that will involve data-driven decision making, financial planning, risk management and the understanding and use of performance measures.

With this course, students will acquire essential infrastructure asset management concepts and knowledge for effectively managing infrastructure systems; students will learn and gain understanding of the applications and benefits of IT for managing infrastructure assets. Students will, also, be ready to further their study in this area by taking related courses offered by CEE and other schools at Georgia Tech. The relevant courses will be introduced. No prior programming, database, or GIS knowledge is required. CEE 3000 is a prerequisite, primarily for the engineering economics component.

Course Objectives

This course is designed for students to learn the general concept and advanced topics in infrastructure system management and prepare them to scientifically and systematically manage a large-scale of infrastructure asset in the future. Upon successful completion of this course, students should be able to:

- a) Articulate the general concept and components of infrastructure asset management;
- b) Explain why and how to collect asset condition data and define its health index, using database management system, GIS, and various emerging sensing technologies;
- c) Explain why and how to model project-level performance curves;
- d) Explain why and how to define the network-level performance measures;
- e) Apply life-cycle cost analysis to evaluate different MR&R alternatives;
- f) Make decisions on network-level MR&R to fulfill system performance requirements and satisfy budget constraints;
- g) Incorporate risk management concept and sustainability in an infrastructure management system.

Course Book: *Public Infrastructure Asset Management (2nd edition) by Waheed Uddin, W. Hudson, Ralph Haas (2013).*
Other readings will be provided as they are assigned and posted in TSquare

Honor Code: Students are expected to perform class activities according to the standards outlined in the Georgia Tech Academic Honor Code. Appropriate action will be taken if any student is suspected of violating the Honor Code. For questions about the Academic Honor Code, please consult www.honor.gatech.edu.

Homework Policy: Homework will be assigned throughout the semester.

Exam Policy: Exams will cover material presented in the textbook, in class (lecture, notes, handouts, overheads, etc.), in homework, on field trips, and in projects. Exams are closed book and closed note. Exams must be taken as scheduled. Only university excused circumstances will be considered.

Attendance Policy: Regular attendance is expected. Each student is responsible for all material and administrative instructions given during the lecture period. Instructions will not be repeated outside of class. Attendance will be taken periodically throughout the semester. Eating, chewing gum, sleeping, talking, using cell phones, or working on assignments for this or any other class (other than any authorized class activity) is inappropriate, discourteous, and inexcusable.

Academic Accommodations for Students with Disabilities: Reasonable accommodations are provided to self-identified students with disabilities who meet the academic and technical requisites for admission or participation in the program of study. Incoming students with apparent course work deficiencies due to a disability should contact the coordinator for Students with Disabilities at 404-894-2564.

Course Evaluation

Homework Assignments	20%
Midterm Exam/Quiz	40%
Term Project	30%
Participation	10%

Additional Information

1. Guest speakers will be invited to give talks throughout the semester.
2. Field trips will also be arranged.
3. Additional readings including papers will be given for the appropriate course modules and assignments.
4. The instructor reserves the right to modify the course syllabus and schedule as necessary. Any changes will be announced in advance in class.

A list of invited speakers:

1. Invited Talk 1: **Transportation Asset Management: Challenges and Opportunities**. Guest Speaker: Ms. Meg Pirkle, P.E., GDOT Chief Engineer.
2. Invited Talk 2: **Bridge Asset Management – Current and Future**. Guest Speaker: Mr. Bill Duvall, P.E., GDOT State Bridge Director.
3. Invited Talk 3: **Infrastructure Management at Hartsfield-Jackson Atlanta International Airport**. Guest Speakers: Mr. Bob Mahfood, P.E. and John Rone, P.E., Hartsfield-Jackson Atlanta International Airport.
4. Invited Talk 4: Melissa Wheeler, P.E. **Transmission Services, Georgia Power**.

Tentative Schedule – REVISED (9/7/2016)

Week	Date	Lecture	Material	Homework
1	Aug. 23	Introduction to Infrastructure System Management (1) ASCE Infrastructure Report Card	Chapter 1, 2, 3	
	Aug. 25	Group Work: Why Do We Need Infrastructure Asset Management? (Part 1: House Improvement)		GHW#1 Assigned
2	Aug. 30	Introduction to Infrastructure Asset Management System (2)	NCHRP Web Document 41(Chapter 1 & 4)	
	Sep. 1	Infrastructure Management Using Information Technologies (Database Management and GIS) (1)		
3	Sep. 6	Infrastructure Management Using Information Technologies (Database Management and GIS) (2)	Supplemental material	
	Sep. 8	Group Work: Why Do We Need Infrastructure Asset Management?		
4	Sep. 13	Infrastructure Conditions and Data Collection (1)	Chapters 5, 6, 7	Term Project Assigned
	Sep. 15	Infrastructure Conditions and Data Collection (2)	Bridge Inspectors Reference Manual	
5	Sep. 20	Gallery Walk of Infrastructure		GHW#1 Due GHW#2 Asgn.
	Sep. 22	Field Trip: Pavement Condition Evaluation	GDOT PACES Manual LTPP Manual	
6	Sep. 27	Invited Guest Speech #1		
	Sep. 29	Performance Measure and Performance Modeling	Chapter 8, Supplemental material	

7	Oct. 4	Term Project: Pre-proposal Meeting		GHW#2 Due
	Oct. 6	Field Trip: Bridge Condition Inspection	Supplemental material	IHW#1 & 2 Assigned
8	Oct. 11	Fall Recess		
	Oct. 13	Invited Guest Speech #2 & Exam Review and Discussion		
9	Oct. 18	Mid-term Exam		
	Oct. 20	Performance Measure and Performance Modeling (2)		
10	Oct. 25	Invited Guest Speech – #3		
	Oct. 27	Engineering Economics and LCCA	Chapter 14, Supplemental material	
11	Nov. 1	Infrastructure M&R Planning and Programming (1)	Chapter 11, 13, Supplemental material	
	Nov. 3	Infrastructure M&R Planning and Programming (2)	Chapter 15, Supplemental material	IHW#1 & 2 Due
12	Nov. 8	Georgia DOT Asset Management System		
	Nov. 10	Sensing Technology for Data Collection and Demo of Georgia Tech Sensing Vehicle		
13	Nov. 15	Term Project: Progress Report		
	Nov. 17	Invited Guest Speech – #4		
14	Nov. 22	Questions and discussions		
	Nov. 24	Thanksgiving Holiday		
15	Nov. 29	Risk Management and MAP 21/FAST Act and Sustainability	Supplemental material; Chapter 20	
	Dec. 1	Student Presentations of Term Project		
16	Dec. 6	Student Presentations of Term Project	All Term Project Reports Due Dec 6th	Term Project Report Due
	Dec. 8	Reading period, no class		
17	Dec. 8-15	Finals Week		