FALL 2019

Days and Dates: Mondays from August 26 through December 3, 2018 (14 Class Sessions)
All exams will be administered during scheduled class sessions – no separate final exam date is scheduled
Time: 6:00 to 8:45 PM with a 15 minute break
Location: Mann Hall room 406

INSTRUCTOR
James A. Rispoli, M.S. (Civil Engineering), M.A. Business, P.E.
Senior Lecturer, Department of Civil, Construction and Environmental Engineering
Professor of Practice, Center for Nuclear Energy Facilities and Structures, Department of Civil, Construction and Environmental Engineering, NC State University
215 Mann Hall
(919) 515-7628
jarispol@ncsu.edu
Office Hours: One-half hour or more if needed, prior to each Monday class session. Other times by appointment. Since there will be both on-campus students and distance-ed students, opportunities for telephone discussion with individual students can be arranged by email.

COURSE OVERVIEW

This course is intended to build on a traditional bachelor’s degree in an engineering discipline, and introduce the engineer graduate students to a multi-disciplinary approach to engineering and management required in the field of facilities engineering. James Rispoli, the course instructor, is a licensed professional engineer with 15 years experience at installation level: as chief of engineering, chief of facilities planning and programming, director of facilities and public works at a major airport, and director of public works, facilities and environment at a major seaport. Additionally, he was facilities and environmental planning department head for a federal agency, covering installations in a 24 state area. He will bring the practical aspects of facilities engineering and management, along with a case study based on an actual situation, to the course material. The students will have the opportunity to evaluate, analyze and propose solutions to facilities engineering challenges presented in assignments and the case study.

COURSE OBJECTIVES

The owner’s facilities engineer has a complex, multi-disciplinary and sometimes overwhelming role. Such engineers include those in positions in a city public works department, a state department of transportation, a regional airport authority, a seaport authority, a university facilities management department, a facilities planning department, a military base public works or base civil engineer organization; or, in the private sector, a plant engineer at a refinery or power plant, a utilities high voltage transmission system, or an engineer with responsibility
for a physical plant and buildings. Additionally, engineers in firms which have facilities engineering organizations as their clients, would find themselves practitioners in facilities engineering. This course is intended to provide engineers working in these organizations, or aspiring to work in such organizations, with the engineering and the management tools to improve their effectiveness as an engineer leader or manager, or journeyman engineer.

Specifically, the course objectives include the ability to:

1. Understand the principles of and be able to organize, plan, direct, coordinate, and control activities where people, money, and materials are efficiently and economically combined to provide effective engineering, facilities, and infrastructure support services. Implicit is an understanding of the technical and managerial instruments available for proposing and implementing objectives, policies, and programs; policy analysis, program planning, and budgeting; accounting, evaluation, and control; and manpower planning.

2. Apply general knowledge of systems analysis problems solving models, network analysis, cost-benefit analysis, and the role of systems analysis in public works/infrastructure decision making.

These abilities are typically required for engineers involved in Public Works Engineering & Management (public sector) and Facilities Engineering & Infrastructure Management (private sector equivalent term).

Because of cyber threats, it is increasingly critical for the engineer to have an understanding of cyber security fundamentals as they apply to the nation’s critical infrastructure (e.g. power/utility distribution grid control systems) to include knowledge and skills in computer network architecture and operations, an understanding of cyber-attack and exploitation methods, cyber system defense mechanisms, as well vulnerability and risk assessment abilities. (Cybersecurity of Critical Infrastructure Control Systems). However, although this course will discuss the importance and applications of cyber security, the student desiring more detailed knowledge and application of this subject should enroll in a course specific to this content.

**READINGS**

**Required Text 1**

**Required Text 2**
Note: This text will be provided electronically to the students at no cost. It is in the public domain.
Other Reading Materials

ASSIGNMENTS

Readings
Readings, primarily from the two texts, and also from the other sources, will be assigned; these are to be completed before the class session that is designated. Reading assignments are shown in this Syllabus, and will be augmented with other readings as announced beforehand.

Homework
Written homework assignments will consist of short papers such that the student understands the lecture material. There will be 4 such homework assignments throughout the 14 week semester and each must be submitted according to the dates shown in Table 1 (posted on Moodle). Arrangements for distance students will be provided through the EOL Homework Office. Homework assignments will be a mix of individual assignments, and team assignments.

Case Study
One additional assignment (i.e. a 5th assignment) will be a student-group-developed case study. The case study will be provided by, and presented by, the instructor. The student–groups will develop the case study to demonstrate understanding, and provide analytical solutions to the problem presented. This will require preparation of a presentation with speaker notes. On-campus students will present their case study in groups; it is envisioned that distance-ed students will be afforded a similar method for their group presentations.

*NOTE:* All assignments will be graded on communication skills as well as content.

TESTS

In order to demonstrate mastery of the course material, there will be two or three in-class exams given by the instructor. Although these exams are not necessarily cumulative, the material in the course builds upon itself; thus, the student may need to be familiar with material from the first exam in order to successfully complete material on the next exam.

There will not be a separately scheduled final exam. The exams are closed book with no access to the internet or electronic notes/text permitted. However, the student may bring Text #1 by Roper and Payant, to the exam site, and use it during the tests. NO SHARING of the Text will be permitted during the exams.
The exams will be given in class according to the dates in Table 1 (posted on Moodle). Arrangements for distance students will be provided through the EOL Exams Office.

**EGR 590/CE 590 COURSE GRADES**
The overall course numerical grade will be calculated based on a weighted average as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student attendance and participation</td>
<td>10%</td>
</tr>
<tr>
<td>Case Study – team assignment</td>
<td>(1)</td>
</tr>
<tr>
<td>Individual and/or team assignments</td>
<td>(4)</td>
</tr>
<tr>
<td>Exams</td>
<td>(2 or 3)</td>
</tr>
</tbody>
</table>

Final course numerical grades will be rounded to two decimal places for assigning letter grades. Letter grades assigned will be no lower than:

- A+ (97-100)
- A (93-96.99)
- A- (90-92.99)
- B+ (87-89.99)
- B (83-86.99)
- B- (80-82.99)
- C+ (77-79.99)
- C (73-76.99)
- C- (70-72.99)
- D+ (67-69.99)
- D (63-66.99)
- D- (60-62.99)
- F (less than 60)

**POLICIES AND PROCEDURES**

**Professionalism**
Each student is expected to conduct themselves in a professional manner. This includes, but is not limited to, arriving to class on time and staying for the full duration; being respectful of the instructor and other students; participating in group activities and discussions; refraining from the use of laptop computers, cell phones, and text messages. Furthermore, oral and written communication with the instructor and other students is expected to be at a professional level.

**Late Assignments**
Unless agreed upon with the instructor prior to the assignment due date, late assignments will not be accepted without assessment of a penalty for being late.

All assignments are due at the start of the class session or as otherwise indicated, as shown in this Syllabus, and on Table 1 (posted on Moodle). If an assignment so due, is submitted during the class or right after the class, or is otherwise late, a **maximum of 50 percent will be earned for that assignment.**
If it is necessary to submit a late assignment, please discuss the situation with the instructor as soon as possible; the instructor will evaluate each situation on a case-by-case basis.

Re-Grading of Assignments
If the student feels that a portion of an assignment has been unfairly graded by the instructor, the student may re-submit the assignment to be re-evaluated by the instructor within one week after it was originally returned to the student. However, the instructor reserves the right to re-grade the entire assignment and not just the portion that is in question by the student. Thus, it is possible for the student to receive a revised final grade on the assignment that is lower than the grade that was received originally.

Academic Integrity
It is the instructor’s expectation that each student will neither give nor receive unauthorized aid on any assignment. Students may discuss the homework assignments if they wish but each student is expected to submit their own assignment. For the tests, use of the text book, course notes, or other material is not allowed unless specified by the instructor. Additional information regarding academic integrity may be found in the NC State University Code of Student Conduct.

Students with Disabilities
Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 515-7653. For more information on NC State’s policy on working with students with disabilities, please see the NC State University Academic Accommodations for Students with Disabilities Regulation (REG02.20.1).
WEEK ONE

Class Session One – Monday August 26

Discuss the components of the class sessions:
- Pre-reading assignments before Class Sessions
- Lectures
- Guest Lecture(s)
- Individual research and papers – some may be presented by the student or the instructor to the class
- Student-groups to develop a case study as provided by the instructor; these will be presented by the student-groups in class sessions.
- In-class exams (2 or 3)
- Classroom discussion as may be practical

Opportunities to discuss any questions on assignments are available, either during class time, or during office hours as described above.

Introduction Lecture:
Discuss Facilities Engineering and Facility Management
Distinguish between the two and show common elements
Differentiate Facilities Engineering
Organization of the Public Works Department
Variability of functions and responsibilities
Functions of departmental elements

Required Reading for Session One:

Facilities Engineering & Management Handbook, Chapter 7 excerpts as posted to Moodle site.

Learning Objectives:
The student will demonstrate understanding of the basics of facilities engineering and facilities management systems.
The student will be able to articulate typical scope and functions of a public works/facilities engineering department.
The student will be able to discuss, at an introductory level, considerations on planning and executing required work.
The student should display an understanding of the interrelationship between various in-house staff elements and related manpower/expertise in a facilities engineering department/public works department.
Assignment #1 due at beginning of Class Session 3 on Monday September 16:
(Note that Monday September 2, Labor Day, is a national holiday and a NCSU holiday.)
See the Class Schedule and the Lecture 1 Assignment towards the end of the lecture notes.

WEEK TWO  (Note: Monday September 2 is a National Holiday, and there are no classes.)

Class Session 2 – Monday September 9

Read before Class Session 2:
Text 2, Continue reading Section 2, through Section 2-9
Text 1, Chapter 24 (also pertinent to class session 3)

Lecture:
Define and discuss facilities engineering terms to include maintenance, repair, construction, operations. Practical cases will be presented.

Learning Objective:
The student will be able to articulate the difference between categories of work on physical assets, whether vertical construction, horizontal construction, utilities systems, electrical systems, environmental systems.

WEEK THREE

Class Session 3 – Monday September 16

Due: Assignment #1 from Class Session One – all written assignments (unless otherwise stated) are due at the start of the class session. Be prepared to discuss your assignment in the class session – both power point capability and document camera will be available.

Read before Class Session 3:
Text 2, Re-read Section 2-5
Text 1, Section II and Chapter 3, pages 59 – 104
Text 1, Chapter 24 (previously assigned)

Lecture:
Discuss importance of credible condition assessments of facilities, including the terms Annual Inspection Summary, and Facilities Condition Assessment Program. Demonstrate development
and formulation of a risk-informed prioritization and budget that considers aspects of mechanical engineering, electrical engineering, structural engineering and civil engineering (including environmental engineering and failure consequences) in that prioritization scheme. Discuss and be able to evaluate consequences of failure resulting from a lack of scheduled maintenance, or required repair.

The in-class students, and/or the instructor may (if time permits) present a selection of Assignment #1 student papers turned in today. Not all will necessarily be done this during this class; these may continue into the next Class Session.

**Learning Objective:**
The student will demonstrate understanding of a range of methods to perform inspection and assessment of facilities conditions, utilizing in-house technical personnel from the trades, and engineers within the organization. Additionally, the student will be able to articulate how the results of such condition assessments would be used in budget formulation and the role of engineering principles in prioritization across disciplines.

**Introduction of a Case Study.** The Case Study will describe a situation showing a backlog of maintenance and repair, a limited budget, and evaluation of alternatives using a risk-informed approach to prioritize a facilities engineering work plan for the year. The situation in the case study will be discussed by the instructor. **Student-groups’ presentations on this case study will be on October 21, Class Session 8. Each student-group will develop their presentation so as to not exceed 10 minutes. The student groups will be comprised of 5 - 6 individuals each.**

**Integral to the Case Study:** The *Power Point presentations and talking notes developed by each student-group are due at the scheduled start of the Class Session on October 21. Student-groups should bring their presentation on a USB drive to use for display in class. Each student-group must provide a printed copy with talking points for grading.*

**WEEK FOUR**

**Class Session 4 – Monday September 23**

**Read before Class Session 4:**
Text 1, Pages 82-102
Washington Post Express article of December 2, 2016 on the derailment of a Silver Line Washington DC system Metro train in July 2016. (provided by the instructor)
Research on-line and read other reports of the July 2016 derailment, accuracy of valid condition assessment of trackage, and consequences.
Reports from January 2015 on a fire in the DC Metro system, near the L’Enfant Plaza station. (provided by the instructor)
Research on-line and read reports of a January 2015 fire in the DC Metro system.

Lecture:
Continue discussion of the importance of credible condition assessments of facilities, and introduce real-world examples of failures resulting from not having credible condition assessments.

Discuss the derailment occurring on July 29, 2016. Consider methods to insure QA of maintenance functions.

Discuss the fire occurring on January 12, 2015, what apparently caused the fire, and whether response to the fire, and life-saving requirements, were adequate. Consider the impact of not having a clearly established set of roles and responsibilities between the DC Metro system, and the DC (or any other local/regional government agency) for response to such an incident.

Discuss in what ways inadequate facilities assessment (structural, electrical) could have contributed to these two distinct events.

Introduce the aspect of initial Metro system planning, the configuration of the system, the life-cycle cost and benefit analysis to include future capacity expansion and constraints on maintenance.

The in-class students, and/or the instructor may (if time permits) continue with presentations of Assignment #1 student papers turned in last week.

Learning Objective:
The learning objective will be matured by the end of Class Session 5.

Assignment #2
Due Next Week (due at the start of scheduled Class Session 5 on Monday September 30):

Assignment: In a two or three page (max) paper, discuss these two incidents with the Washington DC Metro system. You may also research other similar incidents since January 2015 in the DC Metro system.
IMPORTANT: You will develop this paper in the “role” of a newly hired senior engineer-manager, brought in by WMATA to assess and correct the systemic problems. Discuss how, from an engineering perspective, the importance of facilities condition assessments not only to maintenance planning and budgeting, but also the risk-informed potential consequences of failures such as these. Also, discuss how, as the new senior engineer-manager, you would
consider ways to provide more credible condition assessments going forward. Will the engineering department be involved, and how?

WEEK FIVE

Class Session 5 – Monday September 30

Assignment #2, the paper assigned in Class Session 4 is due at the start of class session 5. (unless otherwise noted, all written assignments are due at the start of the class session).

Read before Class Session 5:
Text 2, re-read Section 2-6
Text 1, Section V, Chapters 11 and 12

Lecture:
Discuss projects and categories of projects. Explain the difference between maintenance projects, repair projects, and construction projects. Distinguish that, even though construction trades and processes are used for all three, there is a difference between these types of projects. Discuss capital budget projects, and operational budget projects. Discuss the Davis-Bacon Act as it applies to construction trades in Federally-funded projects.

The in-class students, and/or the instructor may (if time permits) present a selection of student papers turned in today. Not all will necessarily be done this during this class; these will continue into the next Class Session.

Learning Objective:
The student will demonstrate an understanding of the difference between construction trades, vs. the types of work that construction trades perform, i.e. construction, repair, and maintenance. Understand applicability of the Davis-Bacon Act. Reinforce (through student-paper presentations) the importance of valid condition assessments.

EXAM #1

WEEK SIX

Class Session 6 – Monday October 7

The in-class students, and/or the instructor will present student papers turned last week.

Learning Objective:
SYLLABUS – EGR 590 / CE 590
INTRODUCTION TO FACILITIES ENGINEERING SYSTEMS

The student will be able to articulate elements of a facilities assessment program, how the results of that program are used in maintenance planning, and budgeting, and the consequences of inadequate assessments. The student will also be able to explain how engineering principles from various disciplines should be employed to raise the credibility of the assessment program.

WEEK SEVEN

Class Session 7 – Monday October 14
Read before Class Session 7:
Text 2, Section 6
*The Military Engineer, 4/18/17* article on pollutants in stormwater runoff (provided by instructor).

Lecture:
Present a compendium of environmental laws and requirements. Explain that since the laws and requirements are “media” specific, a range of engineering skills and knowledge is required to insure that the facilities’ activities are in compliance with the various laws.

Learning Objective:
The student will demonstrate knowledge of the different laws, what types of activity these laws regulate, and the responsibilities of the facilities engineer in responsible operations and compliance with the laws and regulations.

Assignment #3
Due at beginning of Class Session 9 on October 29):

Assignment: Each student will conduct on-line research to identify an instance wherein a facilities engineering organization failed to comply with environmental law or regulation, and where *an individual is being held accountable by either a fine, or a trial in the criminal justice system*. Discuss the circumstances that led to the violation, what the facilities engineer/facilities engineering organization did wrong, and what could have been done to avoid the violation. Write a 2 or 3 page paper to present this case.

WEEK EIGHT

Class Session 8 – Monday October 21

Due:
The student-groups’ presentations on the Case Study assignment as assigned in Class Session 3 are due by the scheduled start of class session today. Each presentation must not exceed 10 minutes, must have a Power Point presentation along with speaker’s notes. Student-groups should bring their presentation on a USB drive to use for display in class. Arrangements for the distance-ed student teams will be provided.

Learning Objective:
The students will have the opportunity to see and hear their classmates’ evaluation of the situations in the case study. It is the intent that some of the various approaches to the problem presented can be appreciated, and the students will see opportunities to apply the ideas and approaches perhaps in their own work situation, or in a future work situation.

WEEK 9

Class Session 9 – Monday October 28

Assignment #3, the paper assigned in Class Session 7 is due at the start of class session 9. (unless otherwise noted, all written assignments are due at the start of the class session).

Read before Class Session 9:
Text 1 Section VIII Chapter 23, pages 391 to top of 409
Text 2, page 3-29 top
Text 2, Sections 4-6 to 4-8 and Section 5

Lecture:
Today’s lecture will be in two parts. The first will be devoted to safety in the workplace. The typical dispersion of the work place for public works personnel involved in facilities engineering, maintenance and repair tasks is a challenge. The type of work and working conditions are not always as controlled as would be desirable from a worker safety perspective. Practical lessons learned and suggested best practices will be discussed. Application of multi-disciplinary engineering in this area will be discussed. The second half of the lecture will discuss the multi-disciplinary nature of facilities engineering expertise related to work force specialties in wet and dry utilities, both outdoor and within buildings and facilities.

Learning Objective:
The student will be able to explain work force activities, the types of work the inherent hazards with different types of work, and what the facilities engineering leaders and managers can do to influence the organization of work and the safety of operations to protect the workers. The student will demonstrate knowledge of challenges confronting the facilities engineer and the workers in the PW organization, along with how some best practices can be applied.
WEEK TEN

Class Session 10 – Monday November 4

Read before Class Session 11 (suggest start early – this is a lot of reading):
Text 1, all of Section IV, and all of Section VI.
Text 2, section 1-6.

EXAM #2 (to be determined) (before or following guest speaker)

Lecture:
Guest Speaker – the facilities engineer at a major university in the UNC system will discuss topics critical to the operations of the facilities engineering organization.

Learning Objectives:
The student will gain a first-hand perspective of the challenges and opportunities presented in facilities engineering at a university campus.

WEEK ELEVEN

Class Session 11 – Monday November 11

Read before Class Session 11:
Text 1, all of Section IV, and all of Section VI.
Text 2, section 1-6.

Lecture:
The focus of the first part of today’s lecture will be on sustainability, the economic aspects, practical aspects, and implementation. Included in these considerations are total cost of ownership, budget implications, and communication of the trade-off that may be required on first cost, to attain life-cycle optimization. The second segment of this class session will focus on emergency preparedness. The Emergency Management Plan will be discussed, to include the need for an Emergency Management Officer and an Emergency Operations Center. Depending upon the type of facility and organization, the Emergency Management Officer could be the Public Works Officer/Facilities Engineer, or the PWO/FE could be one of the subordinate leaders. Resilience of facilities will be discussed, including readiness, minimization of damage, and restoration of services after an event.

Learning Objectives:
The student will understand the overall concepts, objectives, and implementation of sustainability in planning and in operations of facilities. Additionally, the student will become familiar with sources of information on sustainability, and certification programs currently available. The student will be able to discuss the various types of events that could impact the installation’s operations, including facilities and transportation operations. An understanding of the role of planning and preparedness will be expected, as well as command-and-control during recovery operations. Finally, the student will appreciate current thinking on resilience of facilities.

Assignment #4
Due at beginning of Class Session 13 on November 25:
This will be a student-group assignment, with students in the same groups as for the Case Study. The instructor will present a scenario requiring preparation for a known impending event. The student-groups will develop a 2-3 page paper describing what preparations they would direct as the senior facilities engineer. The product will be a list of the preparations and a timeline starting 4 days before the event, and going until the commencement of the event. The plan should include the activities planned for response for recovery.

WEEK TWELVE

Class Session 12 – Monday November 18

Read before Class Session 12:
Text 1, Chapter 21.
Text 2, Chapter 3.

Lecture:
The various types of contracts will be presented. These will include a discussion of category of work (maintenance, repair, construction) and also the “legal” type of contracts available (construction, services). Refer back to Class Session 5, and discuss the Davis-Bacon Act, the Service Contract Act, and the Brooks Act. Discuss possible locations of the contracting function and organizational implications. Also discuss the Federal Acquisition Regulations (FAR) and possible applicability to the situation. Present organizational variants for the facilities engineer to provide oversight of contractor work, and approve payment.

Learning Outcomes:
The student will be able to discuss and delineate between different contract types, applicability of certain contract laws, and possible chain-of-command for contracting personnel.

WEEK THIRTEEN
Class Session 13 – Monday November 25

Due: Assignment #4 from Class Session 11.
– all written assignments are due at the start of the class session.

Read before Class Session 13:
Text 1, pages 179 – 186, 294 – 295 and 394 – 396
- some of this is re-reading, from sustainability discussions and elsewhere
Text 2, Sections 4-6 through 4-8
Distributed Energy magazine, two articles posted on Moodle

(Required Reading for Class Session 14 – suggest start reading early as it is long:
Text 1, Section V (all))

Lecture:
Energy and Utilities will be the topic of today’s class session. The cost of energy and utilities is a major portion of the budget and annual spend for a large number of facilities engineering/public works organizations. Types of programs to reduce consumption and costs will be presented, along with the facilities engineering organization’s management of the utilities function.

Learning Outcomes:
The student will be able to articulate approaches for management of the utilities function, and also discuss methods to manage energy consumption to reduce costs.

WEEK FOURTEEN

Class Session 14 – Monday December 2

Required Reading for Class Session 14 – suggest start reading early as it is long:
Text 1, Section V (all)

Lecture:
Today’s topic will start with a recap of Programming and Project Development, the engineering design process, and how to choose contract formats. All these are precursors to the construction phase and construction management, in particular, the owner’s functions to promote successful performance of the project through a contract. In some facilities engineering organizations, these functions of construction management/oversight are included, while in others, these functions are done by a separate organization. Current thinking on
construction management for facilities projects (construction, alterations, modifications, repairs, and maintenance (performed by construction trades personnel)) will be presented. Additional inter-relationships between type and form of contract, with the work to be done, will be presented.

Learning outcomes:
While not expecting the student to have a grasp of the full range and depth of construction management, the student will be able to articulate broad and high level concepts concerning the requirements of effective management of construction contracts.

SECOND OR THIRD EXAM.