CE 561—Construction Project Management

Fall 2016

When       Where
4:30–7:15 p.m., Thursday  327 Daniels

Instructor: Dr. Edward J. Jaselskis
224 Mann     Phone: (919) 515-1158
Email: ejjasels@ncsu.edu
Office Hours: TuWF 3:30-4:30 p.m. (or set up appointment)

Teaching Assistant: Parth Malhotra, pmmalhot@ncsu.edu

Engineering Distance Education Program Coordinator: Richard Shryock, email: richard_shryock@ncsu.edu; Phone: (919) 513-3815.

Course Description: Successful Construction Project Management is not only critical to the success of the project engineer, construction manager and the contractor, but reduces overall costs to the owner and society. Modern construction presumes an in depth understanding of the theory and techniques associated with planning, analysis and control. This is a practice oriented, construction project-planning, management and control course emphasizing standard quantitative and qualitative techniques. The Planning, Management, and Control skills necessary to function effectively on complex projects share a common requirement for understanding scheduling, cost control, and their inter-relationship for ensuring successful project performance.

Prerequisite:

BS in Engineering, preferably Civil Engineering or Construction Engineering, or permission by instructor.

Course Objectives:

- Understand the importance of Front End Planning on achieving project success
- Learn about key project management factors related to achieving construction project success and indicators of failure.
- Explore industry best practices in the area of constructability, safety, and value analysis
- Learn how to develop a conceptual estimate using different methods including both deterministic and probabilistic approaches.
- Understand the components of a risk analysis plan and use it for guidance on establishing contingency for a project.
- Learn about core and innovative project control metrics to include in a project execution plan.
- Learn about managing complex first-of-a-kind projects from a technology readiness assessment and commissioning and start-up perspective.
Course Outline:

- Introduction to Project Management and Achieving Successful outcomes. Review basic concepts (60%): front end planning, factors related to achieving project success, industry best practices associated with constructability, value analysis, and safety.
- Project control theory, tools and techniques (30%): deterministic and probabilistic conceptual estimating, core and innovative metrics and indicators including earned value metrics; risk assessment management planning using Monte Carlo simulation.
- Complex project considerations (10%): success considerations for complex projects. This portion will be provided by guest lecturers.

COURSE PHILOSOPHY

This course is intended to present several topics which are critical to the success of projects and from the front end planning phases through start-up and commissioning. The content is equally applicable to owners, contractors, and designers. The success of the course depends on both the instructor and the student sharing a commitment to the learning process. For the instructor, this means adequate preparation, selection of appropriate examples and materials, enthusiasm, and seeking of feedback on the success of instructional efforts. For the student, the success will require interest, enthusiasm, adequate class preparation, and tenacity to explore the subject matter. The topics listed are very broad yet each has a defined body of literature which is far richer than that presented in the course manual. Consider the course material the starting point for learning, and explore each area further as your interests call.

READINGS

Required Text

Other Reading Materials (refer to https://courses.ncsu.edu/ce561/lec/601/)
Supplemental reading on relevant issues will be required throughout the course. The instructor will provide either the document or a link to a website that contains the required reading.

ASSIGNMENTS (refer to https://courses.ncsu.edu/ce561/lec/601/)

Homework
In order to guide the student through the required reading, homework assignments will be given prior for the class period. Each homework assignment will consist of short answer questions from the required reading. There will be ~8 homework assignments throughout the semester and each must be submitted according to the dates shown in Table 1.

Term Paper
For this assignment, you will work individually or in teams of at most two students to explore an area related to construction engineering and management so as to gain a deeper understanding and appreciation of this topic; this can be any topic even ones previously discussed in class. Develop an ability to present your ideas clearly to the class and be able to answer critical questions related to your topic.
Exams
In order to demonstrate mastery of the course material, there will be a final exam in this course given by the instructor. The exam will be given in class (or by proctor for distance education students) during finals week.

COURSE GRADES
The overall course numerical grade will be calculated based on a weighted average as follows:

<table>
<thead>
<tr>
<th>Grading:</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructability Project Assessment</td>
<td>25%</td>
</tr>
<tr>
<td>Probabilistic Estimate</td>
<td>20%</td>
</tr>
<tr>
<td>Homework</td>
<td>15%</td>
</tr>
<tr>
<td>Term Paper</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20%</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 and will result in a zero for the 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 final exam, use of the text book, course notes, or other material is typically not allowed unless specified by the instructor. For the term paper assignment, *proper citation must be given* for other people’s ideas and work; *plagiarism will not be tolerated and will result in a zero for the assignment*. 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)](#).
## Table 1. Schedule for Lectures, Reading, and Deliverables

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture</th>
<th>Date</th>
<th>Topic</th>
<th>Readings*</th>
<th>Deliverable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Thursday, August 18, 2016</td>
<td>Course Overview; Shaping Projects for Success and Trends</td>
<td>See below</td>
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</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Thursday, August 25, 2016</td>
<td>Determinants of Construction Project Success-I</td>
<td>See below</td>
<td>HW 1</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Thursday, September 1, 2016</td>
<td>Determinants of Construction Project Success-II</td>
<td>See below</td>
<td>HW 2</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Thursday, September 8, 2016 (Virtual)</td>
<td>Team Selection and Evaluation for Success</td>
<td>See below</td>
<td>HW 3</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Thursday, September 15, 2016 (Virtual)</td>
<td>Getting the Design Right: Constructability and Technology Readiness; Assign Constructability Project</td>
<td>See below</td>
<td>HW 4</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>Thursday, September 22, 2016</td>
<td>Safety and Project Success</td>
<td>See below</td>
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<tr>
<td>7</td>
<td>7</td>
<td>Thursday, September 29, 2016</td>
<td>Value Analysis/Value Engineering; Assign Term Project</td>
<td>See below</td>
<td>HW 5</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Thursday, October 6, 2016</td>
<td>Term Break</td>
<td>constructs</td>
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</tr>
<tr>
<td>9</td>
<td>8</td>
<td>Thursday, October 13, 2016</td>
<td>Constructability Presentations</td>
<td>Constructability Project and Presentation</td>
<td></td>
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<tr>
<td>10</td>
<td>9</td>
<td>Thursday, October 20, 2016  (Virtual)</td>
<td>Cost, Schedule, Risk I: Conceptual Estimating</td>
<td>See below</td>
<td>HW 6</td>
</tr>
<tr>
<td>11</td>
<td>10</td>
<td>Thursday, October 27, 2016</td>
<td>Cost, Schedule, Risk II: Probabilistic Estimating; Assign Probabilistic Estimating Assignment</td>
<td>See below</td>
<td>HW 7</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
<td>Thursday, November 3, 2016</td>
<td>Cost, Schedule, Risk III: Project Control Metrics</td>
<td>See below</td>
<td>HW 8</td>
</tr>
<tr>
<td>14</td>
<td>13</td>
<td>Thursday, November 17, 2016</td>
<td>Special Topic (Complex Project Success): guest speaker(s)</td>
<td>See below</td>
<td>Probabilistic Estimate Due</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Thursday, November 24, 2016</td>
<td>Thanksgiving Break</td>
<td>constructs</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>14</td>
<td>Thursday, December 1, 2016</td>
<td>Term Project Presentations</td>
<td>constructs</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>TBD</td>
<td>Monday, November 27, 2016</td>
<td>Final Exam</td>
<td>constructs</td>
<td></td>
</tr>
</tbody>
</table>

*See Detailed Schedule below for reading assignments
Detailed Schedule (w/ Reading Assignments)

Lecture #1 (Course Introduction)
August 18, 2016
- Attendance and Welcome Students
- Review Syllabus and Outline
- Wolfware/Moodle Discussion
- Introductions—Learn more about student backgrounds
- Introduction to Project Success
- Importance of Preconstruction Phase
- Megaprojects and the Shaping Process (Merrow)
- Trends in the Construction Industry

- **Readings**
  - *Industrial Megaprojects* (Merrow)
    - Introduction
    - Chapters 1: Megaprojects—Creators and Destroyers of Capital
    - Chapter 4: The Opportunity-Shaping Process

Lecture #2 (Determinants of Construction Project Success I)
August 25, 2016
- Overview
- Devising the Shaping Strategy (Merrow)
- Determinants of Construction Project Success I
  - Pilot Study (feasibility study)
  - Second Phase (Objective factor identification)
  - Brandon Shores Presentation (Average Project)

- **Readings**
  - “Determinants of Construction Project Success” by Ashley, Lurie, and Jaselskis
  - “Achieving Outstanding Construction Project Outcomes” by Salimbene and Ashley
  - *Industrial Megaprojects* (Merrow)
    - Chapter 5: Devising the Shaping Strategy

Lecture #3 (Determinants of Construction Project Success II)
September 1, 2016
- Overview
- Determinants of Construction Project Success II
  - Modeling Construction Project Success
  - Case study: Cerrejon Coal Project (Successful Project)
- Front End Planning (Front End Loading--FEL) (Merrow)
- **Readings**
  - “Optimal Allocation of Project Management Resources for Achieving Success” by Jaselskis and Ashley
Lecture #4 (Team Selection and Evaluation for Success)
September 8, 2016

- Overview
- Megaproject Teams and Organization (Merrow)
- Contractor Selection and Evaluation
  - Analysis of contractor failure
  - Owner evaluation methods for contractors
  - Models for predicting contractor failure prior to contract award
  - Financial indicators of contractors likely to produce claims
- Readings
  - "An Efficiently Structured Approach for Selection of Most Promising Construction Contractors" by Jaselskis and Russell
  - "Quantitative Study of Contractor Evaluation Programs and their Impact" by Russell and Jaselskis
  - "Predicting Construction Contractor Failure Prior to Contract Award" by Russell and Jaselskis
  - "Industrial Megaprojects (Merrow)
    - Chapter 10: Project Definition: Getting the Front End Right
        - Chapters 8: Megaproject Teams: People do Projects
        - Chapter 9: Organizing Megaproject Teams

Lecture #5 (Getting Design Right prior to Execution)
September 15, 2016

- Overview
- Getting Design Right Prior to Execution
  - Importance of having Basic Data prior to Project Execution (Merrow)
  - Technology Development Process (technology readiness)
  - Constructability Improvement Programs
- Discuss Project Assignment #1: Project Constructability Review
- Readings
  - “Constructability Improvement During Conceptual Planning” by Tatum, Vanegas, and Williams
  - "Constructability Primer" Construction Industry Institute
  - "Comparison of Two Corporate Constructability Programs" by Russell and Gugel
  - "Constructability Program Assessment and Barriers to Implementation" by O'Connor
  - "Industrial Megaprojects (Merrow)
    - Chapter 7: Basic Data are Basic: Get Them Right Before You Start Design
Lecture #6 (Safety and Project Success)
September 22, 2016
- Overview
- Safety and Project Success
- Readings
  - "Strategies for Achieving Excellence in Construction Safety Performance" by Jaselskis, Anderson, and Russell

Lecture #7 (Value Analysis)
September 29, 2016
- Overview
- Value Analysis
- Assign Term Report (due December 1)
- Readings
  - “Chapter 15: Value Engineering” Methods in Professional Construction Management

Lecture #8 (Constructability Presentations)
October 13, 2016
- Overview
- Constructability Presentations

Lecture #9 (Conceptual Estimating)
October 20, 2016
- Overview
- Cost, Schedule, Risk I
  - Conceptual Estimating using Deterministic Approaches
- Readings
  - “Conceptual Estimating Notes”
  - “Means 2015 BCCD Data”

Lecture #10 (Probabilistic Estimating)
October 27, 2016
- Overview
- Cost, Schedule, Risk II
  - Probabilistic Estimating
- Readings
  - “Range Estimating Gains Support” ENR
  - “Estimating Plant Construction Costs by Probabilistic Analysis” by Yarmowich
Lecture #11 (Project Control Metrics that Matter)
November 3, 2016
- Overview
- Cost, Schedule, Risk III
  - Project Control Metrics that Matter
  - Innovative Metrics (Earned Schedule, Critical Chain Method)
- Readings
  - “322-1 Metrics that Matter Summary”, Construction Industry Institute
  - “322-2 Project Control Implementation Tool,” Construction Industry Institute

Lecture #12 (Risk Management Planning)
November 10, 2016
- Overview
- Cost, Schedule, Risk IV
  - Risk Management Planning
- Readings
  - “DOE Risk Management Plan”
  - “Integrated Risk Assessment IR-181” Construction Industry Institute
  - “Common Errors in Dealing with Project Risk” by Lukas
  - “Industrial Megaprojects (Merrow)”
    - Chapter 12: The Control of Execution Risk

Lecture #13 (Complex Project Success)
November 17, 2016
- Overview
- Special Topic: Complex Project Success
  - Project Presentation (Guest Speaker)

Thanksgiving Break

Lecture #14 (Term Project Presentations)
December 1, 2016
- Overview
- Discuss Final Exam
- Term Project Presentations
- Course Wrap-up

FINAL EXAM (date to be determined)