

**GEORGE MASON UNIVERSITY**  
**SCHOOL OF INFORMATION TECHNOLOGY AND ENGINEERING**  
**CIVIL, ENVIRONMENTAL AND INFRASTRUCTURE ENGINEERING**  
**Fall 2008**

**CEIE 490 – SENIOR DESIGN PROJECT**

**Instructor:** Laura Miller, P.E., LEED AP  
Adjunct Professor, CEIE  
Phone: 703-507-1227 (Cell)  
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**Class Location:**

Science & Technology I, Room 124  
Fridays 4:30pm – 7:10pm

**Course Reading Materials:**

All texts, class notes, handouts and materials from all previous CEIE courses

Reference: Land Development Handbook 2<sup>nd</sup> or 3<sup>rd</sup> ed., Dewberry & Davis,  
McGraw Hill

Supplemental Materials: Local zoning ordinance, local and state design standards manuals,  
appropriate maps, and county, state and federal websites.

**Primary Course Objectives:**

This course is intended to expose CEIE student to:

1. The engineering design process
2. an integration of all design fundamentals, teamwork and interdisciplinary interaction essential to an effective CEIE design team,
3. a comprehensive design effort including land, transportation, water distribution lines, sanitary sewer collection systems, environmental systems, and storm water management systems, as well as other systems and requirements

**Course Description:**

Capstone design course integrates all design fundamentals employed by a typical urban systems design team. Major team efforts include land use, transportation, water and sewerage, storm water management, site analysis, economic considerations, regulatory considerations, sectioning, grading and siting. Students focus on teamwork, interdisciplinary interactions, and tradeoff decision making. Design team analyzes all aspects of a major urban project, develops solutions to design issues, and produce a project report and oral presentations. The design effort proposed is completed and a report prepared, presented and evaluated. The primary goal of the course is to produce a design for a contemporary urban systems project.

### Course Conduct / Completion of Assignments:

The course will be conducted as a modified seminar to encourage the maximum sharing of opinions, experiences and knowledge of the entire group. Students will be expected to evaluate the applicability of the concepts, theories, and practices developed in the course as they relate to the practicing engineer. An extensive hands-on project will be used to reinforce the concepts.

GMU Honor Code is in effect in this course. Please review the Honor Code statement in the GMU catalog to ensure your understanding of it.

A scope and schedule of submissions will be distributed at the first class meeting. Students will be graded on submissions made in accordance with the submission requirements and schedule. Timely submission of required documents is imperative. In addition, students will be required to make presentations as part of their submission requirements. All students are expected to participate as outlined in the submission requirements.

All documents are to be prepared as if they were required as part of your professional employment, and were to be submitted to the person who sets your salary. All written material should be neatly hand lettered or preferably typed and should consist of complete sentences and paragraphs. Organization and presentation is a key component of the assignments and a consideration in the final grade. Engineering paper should be used when appropriate. Drawings should be neat, made with appropriate drawing implements or done with the aid of a computer, and be completely labeled. Solutions should consist not only of the final answer but also an explanation of how that answer was obtained, a description of any necessary intermediate steps as well as an explanation of any discrepancies (when appropriate). Use of a spreadsheet and/or word processor is encouraged.

Neatness counts -- a minimum of 50% loss of credit will result from sloppy submissions.

### Grading:

#### Required Submissions

15% submission	15% of grade
50% submission & presentation	15% of grade
90% submission	15% of grade
100% submission	
Individual drawings (2 each)	10% of grade
Individual report section (2 each)	10% of grade
Individual journal	5% of grade
Technical Presentation (GMU)	20% of grade
Class Participation / Team Evaluations	10% of grade

## Class Structure

The Senior Design Class will include two (2) Land Development design teams consisting of

	<u>Mentor</u>	<u>Client</u>
Residential Land Development Team	Joe McClellan William H. Gordon Assoc.	Sharon DeMonsabert GMU
Mixed Use Land Development Team	Ron Wagner/Bruce Gould The Peterson Companies	Mark Houck GMU

There will be several mandatory class meetings throughout the semester. These are listed in the syllabus. The classroom will be available nearly every Friday during the entire semester. Laura Miller will be present to provide general assistance with design, regulatory requirements, Autocad, Civil3D, plan preparation, etc. If one or more students requests a lecture on a specific topic, it will be provided. Otherwise, this time can be used for working on the projects or for general help.

## General Project Requirements

The project site is delineated on Fairfax County Tax Map 16-3, ((11)), 6B and 6F. It contains approximately 16.6 acres, and is currently developed with an office building and surface parking. You should assume the existing building and parking will be demolished. Existing utilities will be demolished or relocated as necessary for the new development program. Your construction plans should include information for the contractor to understand not only the new improvements, but what work is required to prepare the site for the new construction.

The site was originally designed in metric units. The existing base sheet has been converted to English units, but the bulk of the information is still in metric. Please pay attention to units – you will need to convert some information to make it useable.

Each team will design the preliminary site layout according to the assigned land use scenario, acceptable to the client. Upon acceptance by the client (i.e. notice to proceed), which is required for the 15% submission, the teams will then perform site design tasks for final layout and design of the following:

1. Land Development
  - a. Site layout, zoning
  - b. Water supply and distribution system, Design and Water Model
  - c. Wastewater collection system, Design and Calculations
  - d. Storm drainage system (inlets, pipes, ditches)
  - e. Storm Water Management – Quantity and Quality
  - f. Erosion and Sediment control
2. Earthwork Analysis
3. Transportation
  - a. Roads, Parking, Vehicular and Pedestrian Circulation
  - b. Frontage Improvements
  - c. Traffic Impact Analysis
4. Quantity Takeoff and Cost Estimate

5. Structural (Required for the Mixed Use Team Only)
  - a. Plans and Design Calculations
6. Environmental (Required for the Residential Team Only)
  - a. LEED – Completion of appropriate LEED Checklist for the development and incorporation of LEED elements in the site design
  - b. LID – Incorporate and detail Low Impact Design Elements in the project

### **Resources**

Resources include the course professor, CEIE faculty, and the teams' client and mentor. **Each team is required to meet with their mentor and their client in person prior to each of the required submissions. A minimum of 20% of the total possible grade will be deducted from each submission for failure to meet with either the mentor or the client.**

The mixed use team should use Prof. Rob Zobel as a resource for the structural design element.

### **Assignments:**

#### **Schedule**

Task out the entire project and prepare a time-line schedule (Gantt chart) in significant detail. Each group will present a 10 minute (max) presentation at the second class meeting. The Gantt chart task will be included in all future report submissions, and should be updated at each submission to reflect actual dates along with the baseline schedule.

#### **Zoning**

Determine the Zoning District best suited to accommodate the assigned land use. The criteria in the selected zoning district will be used to develop the site layout.

#### **Project Drawings**

Each team is responsible for preparation of a complete set of drawings to demonstrate their solution to the design challenge and knowledge of the subject matter. The team should consider constructability of their designs and assume these drawings will be construction drawings, delivered to a contractor to be implemented. Each team member is responsible for preparation of at least two drawings within the set.

#### **Project Report**

Each team is responsible for preparation of a project report, which must be submitted at each milestone throughout the semester. Each team member is responsible for preparation of at least two sections of the report.

#### **Project Journal**

Each team is responsible for preparation of a project journal, which must be submitted at each milestone throughout the semester. Each team member is responsible for preparation of timesheets, meeting minutes, call logs, reports, and other documentation that demonstrates the effort required to complete the task. Journal shall include comments and responses by client, mentor, and instructor for each of the milestone submissions. Timesheets should be organized by team member, with the most recent timesheet on top.

#### **Technical Presentation**

The technical presentation will be a 40-minute presentation, complete with power point, at GMU at the end of the semester. The team will deliver a detailed presentation, sufficient to demonstrate their knowledge of the

technical issues and design procedures and will answer questions posed by experts. Students are encouraged to invite family and friends. This presentation will describe the project, what the requirements were, how the team satisfied the requirements, and may include a discussion of some of the challenges faced and overcome during the semester. The audience will be a mix of technical and non-technical people. Your presentation should be detailed enough to satisfy the technical members of the audience, but not so technical as to lose the non-technical members of the audience. Selected members of the audience will serve as a jury, and will ask questions about the presentation at its conclusion.

### **Final Submission**

The complete set of drawings, project report and project journal is due on December 5.

### **Submission Reviews**

Each milestone requires submission of plans, report, and project journal. Submissions are to be made in class on the due date. Submission materials will be reviewed by the course instructor and comments will be returned at the next class meeting.

**COURSE SCHEDULE**

August 29, 2008	Week 1)	Mandatory - Course Introduction, Teams & Project Assignments Homework Due at beginning of class on September 5, 2008 Develop a Gantt Chart Develop a Sheet Index Establish Zoning Establish Team Name, Standard Timesheet/Report Templates
September 5, 2008	Week 2	Mandatory – Gantt Chart Presentations
September 12, 2008	Week 3	Optional
September 19, 2008	Week 4	Mandatory - 15% Submission Due
September 26, 2008	Week 5	15% Markups returned – Attendance Optional
October 3, 2008	Week 6	Mandatory – Presentation on Presentations
October 10, 2008	Week 7	No Class
October 17, 2008	Week 8	Mandatory – 50% Submission Due
October 24, 2008	Week 9	50% Markups returned – Attendance Optional – FE Exam October 25
October 31, 2008	Week 10	Optional
November 7, 2008	Week 11	Optional
November 14, 2008	Week 12	Optional
November 21, 2008	Week 13	Mandatory – 90% Submission Due – Comments will be returned in written format before the holiday.
November 28, 2008	Week 14	No Class – Thanksgiving Holiday
December 5, 2008	Week 15	Final Presentation – 100% Drawings Due
December 12, 2008	Week 16	Exam Week – no requirements for CEIE 490 – We’re done!

### **15% Submission Requirements**

#### Client Notice to Proceed Required for 15% Submission

1. Project Drawings (1 set, 24" x 36")
  - a. Horizontal Layout of Site Elements including
    - i. Demolition
    - ii. Roads
    - iii. Buildings
    - iv. Pedestrian circulation
    - v. Fire access
    - vi. Parking
    - vii. Handicap accessibility
    - viii. Stormwater management
    - ix. BMPs
    - x. Dumpster
    - xi. Storage
    - xii. Recreational facilities
    - xiii. Fences
  - b. Horizontal Layout of Utilities including
    - i. Storm Drainage
    - ii. Sanitary Sewer
    - iii. Water Distribution
    - iv. Electricity
    - v. Communications
    - vi. Gas
2. Project Report including a brief description in sufficient detail to convey to the reader the concept for provision of provision of each system / element of the project
  - a. Executive Summary
  - b. Project Report showing section headings and designated author for each section.
  - c. Project Schedule - Gantt Chart updated to show baseline and progress through 15% submission date
3. Project Journal
  - a. Timesheets for all team members showing effort on the project through 15% submission date including days worked, number of hours per day, description of effort, daily total hours, weekly total hours, cumulative total hours.
  - b. Meeting Minutes to record all meetings with client (required prior to 15% submission), mentor (required prior to 15% submission), county or state officials, design team, others, either in person or over the phone

### **50% Submission Requirements**

1. Project Drawings (1 set, 24" x 36")
  - a. All items required at 15% submission, further developed to reflect 50% effort and the following additional items:
  - b. Grading
  - c. Horizontal Layout of utilities including electricity, gas, steam, communications
  - d. Road Profiles
  - e. Parking Tabulation
  - f. Zoning Tabulation demonstrating compliance with zoning requirements
  - g. Existing Drainage Divides
  - h. Proposed Drainage Divides with areas, runoff coefficients, and peak runoff calculated for each area
  - i. Stormwater Management Facilities plans, calculations sufficient to demonstrate adequate sizing
  - j. BMP Facilities plan(s), calculations sufficient to demonstrate adequate sizing
  - k. LID Facilities planned for the project
  - l. Transportation Analysis / Recommendations
2. Project Report including a description in sufficient detail to convey to the reader the intent for provision of each system / element of the project.
  - a. Executive Summary
  - c. Project Report with at least two sections authored by each team member, developed to reflect 50% effort
  - d. Project Schedule - Gantt chart updated to show baseline and progress through 50% submission date
  - b. Preliminary Cost Estimate
3. Project Journal
  - a. Timesheets for all team members showing effort on the project through 50% submission date including days worked, number of hours per day, description of effort, daily total hours, weekly total hours, cumulative total hours.
  - b. Meeting Minutes to record all meetings with client (required prior to 50% submission), mentor (required prior to 50% submission), county or state officials, design team, others, either in person or over the phone

### **90% Submission Requirements**

1. Project Drawings (2 set, 24" x 36")
  - a. All items required at 50% submission, further developed to reflect 90% effort and the following additional items:
  - b. Utility Profiles – storm, sanitary, water
  - c. Sight Distance Profiles
  - d. Storm Sewer Pipe Computations
  - e. Storm Sewer Inlet Computations
  - f. Sanitary Sewer Computations
  - g. Water main System Analysis demonstrating adequate domestic and fire flow pressures
  - h. Stormwater Management Facilities plans and calculations including routing
  - i. BMP Facilities plans and calculations demonstrating required phosphorus removal
  - j. LID Facilities plans and calculations demonstrating design and adequacy
  - k. Transportation Analysis with detailed calculations
2. Project Report including a description in sufficient detail to convey to the reader the method for provision of provision of each system / element of the project
  - a. Executive Summary
  - e. Project Report with at least two sections authored by each team member, developed to reflect 90% effort
  - b. Project Schedule - Gantt chart updated to show baseline and progress through 90% submission date
  - c. Final Cost Estimate
3. Project Journal
  - a. Timesheets for all team members showing effort on the project through 90% submission date including days worked, number of hours per day, description of effort, daily total hours, weekly total hours, cumulative total hours.
  - b. Meeting Minutes to record all meetings with client (required prior to 90% submission), mentor (required prior to 90% submission), county or state officials, design team, others, either in person or over the phone

**100% Submission Requirements (1 set, 24" x 36")**

1. Project Drawings – completed submission
2. Project Report – completed including all previously required items
  - a. Project Schedule - Gantt chart updated to show baseline and progress through 100% submission date
  - b. Final Cost Estimate
3. Project Journal
  - a. Timesheets for all team members showing effort on the project through 100% submission date including days worked, number of hours per day, description of effort, daily total hours, weekly total hours, cumulative total hours.
  - b. Meeting Minutes to record all meetings with client, mentor, county or state officials, design team, others, either in person or over the phone

Fairfax County Tax Map 16-3, ((11)), 6B and 6F – 16.6 acres

Team Members: Shwan Fatah  
Jenyl Meszaros  
Joe Mollo  
Sangam Neupane  
Andrew Ramos

Mentor: Joe McClellan, William H. Gordon Associates - 703-263-1900

Client: Dr. Sharon DeMonsabert, GMU

Residential Development

Design a neighborhood using The LEED for Neighborhood Development Pilot Program. The target for this project is Silver Certification, which requires that you obtain 50-59 points out of a possible 106 total points. This is an existing commercial site you will redevelop for residential use to include 120 total units, with a roughly equal mix of townhouses and condominium units. The condominium units should be within a multi-unit building or buildings not exceeding 100' in width or three stories in height with average unit sizes of 1,250 sf. Townhouses should be 22' wide and 50' deep. You will be required to comply with the Fairfax County Affordable Dwelling Units Program.

Your development should include amenities for the residents, including a park, walking trail, and an area for community farming. In addition to meeting the requirements for LEED certification, your project must also meet the requirements of the jurisdiction. Any waivers you will require from the jurisdiction to make this project work should be identified in your report.

In addition to the submission requirements for the project, your team is also required to submit a LEED checklist and LEED Strategies Report with each submission. The LEED Strategies Report should indicate the methods you will incorporate to meet the intent of the LEED certification program. There is a wealth of information available about sustainable development and green construction. Do your research and consider incorporating information and ideas from entities like The Sustainable Sites Initiative, Sustainable Community Initiatives, and Community Forklift.

Because your team will be challenged to create a LEED certified project, you will be exempted from the requirement for a structural element on the project.

Fairfax County Tax Map 16-3, ((11)), 6B and 6F – 16.6 acres

Team Members: Chris Elder  
Ngoc Le  
Carly May  
Katterinne Overcash  
Christian Williams  
Aman Tuteja

Mentor: Ron Wagner, The Peterson Companies – 703-631-7512  
Bruce Gould, The Peterson Companies

Client: Dr. Mark Houck

Structural Mentor: Dr. Rob Zobel

Mixed Use Development

This is an existing commercial site you will redevelop as a mixed use development that includes the following:

- 200 high-rise condominium units in two L-shaped towers with average unit size of 1,400 sf. Assume 12-14 units per floor. Maximum building height is 8-stories. Provide a 5,000 sf fitness facility in the ground level of one of the towers. Parking should be provided in a subsurface parking structure located entirely within the footprint of the two towers. A typical floor plan for the units and for the parking structure should be provided within your plan set.
- Two eight-story office buildings, each with a footprint of 25,000 sf with separate, structured parking. Develop an interesting pattern for the office buildings that compliments the other structures on the site.
- A central park area / pedestrian plaza of approximately 30,000 sf that includes a skating rink, landscaped areas, passive elements (benches, gazebo, etc.), and an area for outdoor concerts. The skating rink should be covered, with the roof structure attached to a small (20' x 36') single-story building for skate rentals, refreshments and restrooms. The design of the skating rink roof and attached building is the structural assignment for the project. Specific requirements for the structural design should be coordinated with Dr. Zobel.
- Retail shops / Restaurants – 20 units at 20' wide x 75' deep and 6 units at 50' wide x 75' deep, with two-story office space above the retail units. Required parking for this use shall be in surface parking surrounding the structures.

The retail shops and restaurants should be placed surrounding the central park.

All the elements of the development should be connected by pedestrian walkways and a perimeter trail should be provided around the property boundary.

You're developing a town center area that should be attractive and user-friendly. Incorporate street trees and planters, benches, etc., so the development encourages people to live, work and shop there.