



## CE 494 – 103 Civil Engineering Design I

### 3 Credits

**Lectures:** Monday 6:00 PM - 8:50 PM CKB 303

**Instructor:** Joseph Baladi, P.E., P.P., CME, CPWM

[Email: joseph.baladi@njit.edu](mailto:joseph.baladi@njit.edu)

Office Hours: Adjunct Instructor - In Class / By Appointment

In case there is a need for virtual meeting room:

<https://njit-edu.zoom.us/j/5420885917?pwd=bGhETVl5MVlwVmg3b0RWTzkwTkZnZz09>

Meeting ID: 542 088 5917

Passcode: 008474

**Prerequisites:** CE 210, CE 260, CE 320, CE 321, CE 350, CE 341, CE 341A, senior standing

**Texts:** No textbook. Handout materials only. Please see details in the course materials section.

#### **Course Description:**

Simulates the submission and acceptance process normally associated with the initial design phases for a civil engineering project. Familiarize students with the preparation of sketch plats, preliminary engineering design, and related traffic calculations and environmental assessment. Requirements include written full set of plans, reports and oral presentations in defense of the project.

#### **Course Objective:**

By the end of the semester, students within the group should be able to produce a typical siteplan application package to Planning Board for approval and construction. Please refer to the deliverable section.

#### **Course Topics:**

Topics learned depend on site selected. Typically the following topics are covered and progress work will be reviewed:

1. Introduction to project site, zoning requirements and other constraints.
2. Subdividing property with meets and bounds description.
3. Site plan, proposed layout and Circulation
4. Preparing construction Drawings
5. Environmental impact analyses and reports.
6. Stormwater management system.

7. Traffic analysis in the report and plan layout.
8. Addressing utilities on site.
9. Paving plans
10. Quantities and cost estimate.

### **POLICIES & PROCEDURES**

**Academic Integrity:**

Academic Integrity: It is expected that NJIT’s University Code on Academic Integrity will be followed in all matters related to this course. Refer to NJIT’s Dean of Students website to become familiar with the Code on Academic Integrity and how to avoid Code violations.

<https://www.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf>

**Communication:** Face to face in class otherwise email [joseph.baladi@njit.edu](mailto:joseph.baladi@njit.edu)

**Lecture/Class:** Students are required to attend all lectures. Class recordings are not permitted without instructor permission. Extended absence needs approval from the Dean’s of Students Office

**Handouts:** Handouts will be posted on Canvas.

**Homework and Final Exam / Grading:** Students are expected to work on the assigned project and report from day one, and consult the instructor on their work process. Students are expected to visit the actual design site, and attend a Planning Board meeting, there will be final presentation, report and project submittal. The Grade will be based on the presentation and the review of the report and plans with 20 percent on presentation and report, and 80 percent on the engineering plans.

Grading 200 total points are assigned to the entire project.

<u>Point Total</u>	<u>Grade</u>
180 +	A
171-179	B +
160-170	B
151-159	C +
130-150	C
120-129	D
Below 120	F

**Instructor Commitment:** You can expect the instructor to be courteous, punctual, organized, and prepared for lecture and other class activities; to answer questions clearly; to be available during office hours or to notify you beforehand if office hours are moved; to provide a suitable guest lecturer or pre-recorded lecture when they are traveling or unavailable; and to grade uniformly and consistently.

**AI statement:** The use of artificial intelligence (AI) is permitted in this course only when

explicitly stated in assignments. If students use AI for any course-related work, they must cite it according to the guidelines provided on the [NJIT Library AI Citation page](#). If you have any questions about AI use in this course, please contact the course instructor before submitting any assignments. In cases where AI use is not allowed, students are expected to complete work without AI assistance to develop their skills in this subject area.

**Students with Documented Disabilities:** NJIT is committed to providing students with documented disabilities equal access to programs and activities. If you have, or believe that you may have, a physical, medical, psychological, or learning disability that may require accommodations, please contact the Coordinator of Student Disability Services located in the Center for Counseling and Psychological Services, in Campbell Hall, Room 205, (973) 596-3414. Further information on disability services related to the self-identification, documentation and accommodation processes can be found on the webpage at: (<http://www.njit.edu/counseling/services/disabilities.php>)

**Course Schedule:**

Meeting /Session	Lecture Topic
Session 1	Introduction to land development, CAD data management, boundary surveys & topographic maps, project management.
Session 2	Project specifics: Location, history, prior use, proposed use, overall significance, and value engineering.
Session 3	Technical attachments & reports associated with the site, survey files, geotechnical report, environmental reports, stormwater issues associated with site, existing conditions that lead to problem statement.
Session 4	Proposed alternatives, descriptions. Includes circulation, zoning, setbacks, density, variances.
Session 5	Design considerations and approach to produce solution that is compatible with engineering standards, green design, ADA accessibility, and other considerations.
Session 6	Drainage analysis, permits required, and hydraulic reports.
Session 7	Traffic analyses, HCS, assumptions, and level of service.
Session 8	Site visit.
Session 9	Complete sample of engineering plans, review, and analysis.
Session 10	Continue review and analysis of sample engineering plans.
Session 11	Engineering design packet and checklist.
Session 12	Review student progress plans. Option To present.
Session 13	Presentations & Discussions
Session 14	Presentations & Discussions
Session 15	Course summary, closing comments and remarks

**Outcomes Course Matrix – CE 494 – 103-105-HM1 - Civil Engineering Design I**

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
<b>Student Learning Outcome 1: Apply a simulated submission and acceptance process normally associated with the initial design phases for a civil engineering project. Prepare sketch plats, preliminary engineering design, and a related environmental assessment.</b>			
Present an open ended civil engineering practice design problem for solution by teams of students.	1, 2, 3, 5, 7	1, 2	Final project report and periodic progress reports.
Discuss specific code, performance, cost, time, quality and safety objectives.	2	1, 2	Final project report and periodic progress reports.
Work individually and within multi-disciplinary design teams.	1, 2, 5, 7	1, 2	Final project report, periodic progress reports, oral presentation of project.

**CEE Mission, Program Educational Objectives and Student Outcomes**

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarships among our faculty and students
- to promote service to the engineering profession and society

**Program Educational Objectives**

Our **Program Educational Objectives** are reflected in the achievements of our recent alumni:

1. **Engineering Practice:** Alumni will successfully engage in the ethical practice of civil engineering within industry, government, and private practice, working towards safe, practical, resilient and sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.
2. **Professional Growth:** Alumni will advance their technical and interpersonal skills through professional growth and development activities such as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as academia, business, and law through further education.
3. **Service:** Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

## Student Outcomes

Our **Student Outcomes** are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
  2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
  3. an ability to communicate effectively with a range of audiences
  4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
  5. an ability to function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks and meet objectives
  6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusion
  7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies
- Updated 8/2025

### **Course Materials / References in Addition to Canvas:**

- A. Site base maps including boundary and topography data (CAD data).
- B. Regulatory code as required.
  1. “Residential Site Improvement Standards”,  
[www.nj.gov/dca/divisions/codes/offices/rsis.html](http://www.nj.gov/dca/divisions/codes/offices/rsis.html)
  2. NJ Stormwater Management Rules [www.state.nj.us/dep/watershedmgt/rules.htm](http://www.state.nj.us/dep/watershedmgt/rules.htm)
  3. Municipal bulk zoning table (CAD data).
  4. NJDEP Stormwater Best Management Practices Manual and Rules  
[www.njstormwater.org/bmp\\_manual2.htm](http://www.njstormwater.org/bmp_manual2.htm)
- C. Reference Materials
  1. Bergen County Soil Survey  
<http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>
  2. Design software and manuals for stormwater management and sanitary conveyance design.
  3. NJDEP Nonstructural Stormwater Points System (NSPS)  
<http://www.njstormwater.org/index.html>

4. Supplementary materials for student review
5. MUTCD, MLUL, RSIS, AASHTO and other State and Federal Manuals
6. Additional online data and mapping resources, i.e. Google Earth, Flash Earth, NJ IMap, etc.
7. Textbooks from previous preparatory courses as well as other related references as required.
8. Reports and materials handed by Instructor

### **Course and Project Report Requirements**

**Project Plans:** Utilizing the above mentioned material each team (5 student's max. per team) will subdivide a parcel of land for single family homes or midrise condominium.

**Oral Presentation:** For the final oral presentations, each team member will present their work to the class by discipline, i.e., transportation/planning, geotechnical, hydraulics/water resources, and environment. You are expected to dress and present yourself in a professional manner. Presentations shall be direct and comprehensive. Each team will be allotted 15 minutes to present their project to a mock planning board in an attempt to be granted approval by the board.

**Planning Board Summary:** Students are also required to attend one local planning or zoning board meeting and prepare a summary report. This shall be one to two pages documenting and discussing the student's findings and opinions on the public meeting and the applications before the board.

**Computer Data and Computations:** Students are required to use available computer applications for required computations in support of the information shown on the plans, profiles and in the reports. Several applications will be available at the NJIT computer facility and outside sources may be used.

**Teams:** The class will be divided into multiple teams. Each team will use a multidisciplinary approach. That means that each team member will assume a discipline-specific role on the project as follows: transportation engineer, planning engineer, geotechnical engineer, water resources engineer and environmental engineer.

**Team Leader:** You will also designate a team leader. The team leader is the project manager and shall coordinate and manage the project. The team leader will assign discipline-specific roles to team members. Teams are expected to take the project from preliminary design through to the final design report and oral presentation. This discipline-specific approach should not prevent one member of the team from helping out another member of the team. In fact, with four disciplines and three members to a team, all team members will collaborate on one of the four disciplines. Each student is responsible for the work in one discipline and must work with his/her team members on a second discipline. The division of project work among the four disciplines is as follows:

- Transportation and planning – Subdivision and bulk zoning compliance, horizontal and vertical road design, traffic analysis.
- Geotechnical – Lot grading, pavement design and soil erosion control and soil movement (cut/fill) volumes.
- Water resources engineer – storm sewers, water quality devices, detention basin.
- Environmental – Project report editor, cost estimate, sanitary sewer system, environmental impact statement and wetland delineation (Transition areas if required).

**Cost Estimate:** You are to use the resources in the library, online or whatever resources are available and prepare a cost estimate of the public site improvements only (stormwater management system, roadway, etc. You are not to include the cost of developing the residential lots.

**Feasibility:** Finally, you are to insure the project is feasible for development by meeting local bulk zoning, the “New Jersey Residential Site Improvement Standards”, and the "New Jersey Stormwater Rule". The final report is used to document that the project meets the governing code. All governing code shall be referenced in the report.

**Reports:** Reports shall include appendices that include all calculations for the storm water management system, traffic, and environmental assessments.

**All calculations are to be initialed by the designer and the person who checked the calculations.** Credit will not be given for unsigned calculations. All your reports are to be concise, well-thought-out and presented in a professional format. The report should explain what you are constructing, where you are constructing it and how these new improvements meet the governing codes. The final report shall document the change in land use, residential density and compliance with governing land development rules and regulations (Local Bulk Zoning , RSIS, Stormwater Rule).

Please remember there will be no extensions granted so use the semester time wisely. Many students underestimate the time required to learn the software, design, organize, publish and present the subdivision design. Students are asked to consider carefully the time required to learn the design process and all of the software required to publish this data. Make copies of your submission as the projects submitted will not be returned.

## Minimum Requirements for Maps and Reports

### Drawing Standards:

1. All existing and proposed property line print black with varying widths.
2. All existing features and contours print in shades of gray with varying widths.
3. All proposed conditions are to print bold black or in color with varying widths.
4. All printed plan labels shall be legible with the naked eye and shall be submitted in an ordered stapled set. The following shall appear on all maps.

### **Unit Precision and Format – All plans:**

1. Contours, P=0.
2. Distances, P=0.01.
3. Elevations, P=0.01.
4. Radii, P=0.01.
5. Angles, DMS to one second (N 90d 45' 33" E).
6. Stations, P=0 for centerline markers at 100', P=0.01 for location.
7. Area, P=0 for square feet, P=0.001 for acres.
8. Volume, P=0 for cubic feet and cubic yards.

### **Content and Format**

All reports shall be typed and presented as a professional report with a cover sheet, table of contents and letter of transmittal. The group number shall be included on the first page or cover of all documents.

Specific reference to all assigned regulatory code is required in all sections. This course will focus on the class assigned municipal/local bulk zoning code and New Jersey Administrative Codes, NJAC 5:21 (RSIS), NJAC 7:8 (The New Jersey Stormwater Management Rules) and the New Jersey Stormwater Best Management Practices Manual.

Reports shall document how the project design conforms to the code and defend any variance and/or waiver relief required. All groups must attempt to design without waiver or variance relief. Any request for design relief must be presented to the course instructor for preliminary approval at least two (2) weeks prior to the final submission date. No design relief will be granted after this date.

### **Honors Classes**

In addition to Sections I through V above honors classes are required to:

1. Compose written legal descriptions for all proposed parcels and easements.
2. Design an outlet control structure and provide a final detention basin design. Construction details are to be provided for the detention basin and outlet control structure.

### **Final Submittal**

Project Report may include the following:

- 1- Introduction: site description, aerial, general location, history, prior use, and overall outlook for the area.
- 2- Existing conditions: Description and problem statement
- 3- Environmental elements: Use the report included with the package to highlight the main issues and executive summary

- 4- Geotechnical Elements: Use the report included with the package to highlight the main issues and executive summary
- 5- Proposal site description: Use, circulation....
- 6- Design Considerations and approach: Applying engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors: Such as Green design, ADA accessibility, economical need for the current market and economy (apts....)....
- 7- Approach and methodology: Acquire and apply new knowledge as needed, using appropriate learning strategies such as analyzing traffic counts, HCS, CAD, Calculations of transition length and other design criteria of AASHTO, MUTCD
- 8- Drainage calculation, size the detention system, pipes
- 9- Traffic reports and analysis, calculation of LOS of intersection or circle using appropriate software
- 10- Cost estimate for your construction site work, do not include the actual building cost
- 11- References: List of all references you used: RSIS, AASHTO, MUTCD, reports,...
- 12- Name of the project and the name of each student and the engineering discipline should be on the cover of the report and plans.

Plan Set:

\*Refer to sample Essex Street drawings in your package for more details indicated on each sheet.

1. Cover sheet: North arrow, keymap, address, scale, date, a place holder chart for properties owners within 200 ft (you do not to have actually list the individual owners for the sake of time limitation), utilities list, project name, block and lot. Quantity chart, and units (no pricing). List of all drawings in the set with page number.
2. Existing plan
3. Proposed subdivision: Prepare a subdivision plan depicting and dimensioning the following.
  - a. Title Box, north arrow, scale.
  - b. Existing ground features. No contours or elevation data.
  - c. Existing and proposed right of way (R.O.W.), lot lines and protected or restricted lands.
  - d. Alignment controls such as PI, PC and PT points as well as CL curve radii labeled.
  - e. Proposed road names and widths.
  - f. Proposed parcels numbered with areas reported in acres and square feet, lot lines and curves with meets and bounds labeled.
  - g. Zoning table identifying bulk zoning compliance and any required variance for each lot.
  - h. Proposed easements labeled with name, area and meets and bounds.
  - i. Call out labels
4. Proposed siteplan: Footprint of building, floor elevation, areas, access, traffic control device, parking, road, mandatory road widening.
5. Construction drawing, cross section, longitudinal profile, quantity calculation, show all of the work that will be done in the field, include ADA Ramps.
6. Pavement plans: Maybe also included with construction drawing
7. Utility plans, drainage, relocation of utilities....
8. Signing and striping plans, ADA, crosswalks, stop bars, lane striping, arrows, paint quantities, and all site signage such as R3-8, pedestrian....
9. Detail Sheet: shows all details that are used, such as curb, manhole, inlets, plantations....
10. Drainage calculation (in not included in the report)
11. Traffic analysis & Cost Estimate. (if not included in the report)

**One combined PDF file, named by the class – section – group and each student last name: CE494-SectionXXX\_Brown - Smith - \_\_\_\_\_ .pdf**

**PDF file includes your report, a set of plans, and presentation materials. USE PDF Pro to combine everything into ONE PDF document.**

Instructions for printing to PDF

1. Set Name to DWG to PDF.pc3
  - a. Properties
    - i. Custom properties
      1. Additional output setting
        - a. Uncheck “Include layer information”

Name of the project and the last name of each student and the engineering discipline that you worked on should be on the cover of the report and plans.

**Additional Notes:**

1. The class will cover material above and beyond your project and presentation.
2. It is advised to read the entire handout, and attend suggested NJTPA, DOT meeting and conferences when possible.
3. Attendance will be taken at the beginning of the class and may affect your final grade.
4. In case of any student misses a class, or fail to submit assignment or presentation on time, the Office of the Dean of Students is the only entity that would determine the legitimacy of the absence or the situation via a written email addressed to the course instructor.
5. It is the student's responsibility to contact the office mentioned above and make his/her case with proper documentations.
6. Students within the same group may get different grade based on class & group participation.
7. Planning Board attendance, and summary report is mandatory as part of the project but will not be graded.

The presentation and plans are due on: **Monday November 10, 2025, early submittal.**

**Monday December 8, 2025, latest Submittal**