Objective – This course introduces students to the functionality, planning, design, and operation of key infrastructure systems which underlie contemporary society, and provides a structured, interdisciplinary exercise in facility design. For seniors in Civil and Environmental Engineering, this course is a capstone design experience in which they will bring to bear the variety of concepts and tools they have learned in other courses. For other students, engineers and non-engineers alike, this course provides both a technical overview of essential infrastructure components, as well as a team design experience in which students from a variety of backgrounds can contribute their own disciplinary expertise.

Target Market – The course is targeted to senior Civil & Environmental engineers, but it is open to all engineers and other students with at least junior standing and permission of the instructors.

Approach – The course is taught through a series of examples, beginning with the theory and concepts associated with a particular system type, accompanied each week by a field visit to an example system. The theoretical and conceptual elements include:

- objectives and functions for systems
- system organizations and interactions
- design characteristics and the factors that determine them
- finance and ownership patterns
- supporting institutional frameworks
- contemporary problems and options
These theoretical and conceptual elements are accompanied by the opportunity to observe important infrastructure facilities firsthand, and learn about them from engineers and others responsible for their design, construction, and operation.

In parallel with this general study of infrastructure systems, students are organized into small (4-6 members) interdisciplinary design teams, which undertake a quarter-long design activity culminating in a facility design presented as a professional quality oral briefing supported by a written or web-based report. Team composition is based on a survey of students’ experiences and skills, as well as their major and intended professional disciplines. The goal is to have teams that are balanced with capabilities in structures, soils, environmental engineering, transportation, project management, computer-aided design, and project teamwork.

**Course Operations** - The infrastructure elements are covered in weekly two-hour lecture-discussion sessions. Weekly field trips to infrastructure facilities in the Chicago Metropolitan area are tied to the lectures, and are scheduled for the entire afternoon on most Fridays. Trips will be led by the instructors and expert facility managers and engineers to give students a true insider’s view of each system. Field trip attendance is required.

The design project topic for the quarter is selected by the instructors. For Spring 2007, the topic is design of temporary (emergency) housing, including location criteria, site preparation, provision of utilities, structure design, selection of materials and manufacturing processes, deliver logistics, installation and maintenance.

Design activities are supported by course faculty and a team of faculty and professional mentors selected to assist in the technical work of students in such fields as water supply and wastewater treatment, structural design, building construction, logistics, project finance, and management.

Instructors will meet design teams weekly, mixing counseling and workshop sessions so that students get sufficient technical review and advice and spend remaining time in substantive design workshops. Technical mentors will participate in these weekly sessions as needed for advice and design review.
Student teams will be required to make three interim progress report presentations, in addition to the final report presentation.

Course Schedule – Spring 2007 – tentative, field trips are subject to change

Week 1:

Lecture/discussion: Introduction; What are infrastructure systems and why do we care about them?

Design workshop: Organizing for project management. A guest speaker will discuss project management methods.

Field trip: Field assignment: Exploring Urban Infrastructure in Downtown Evanston. E-mail report on urban exploring

Week 2:

Lecture/discussion: For-Profit Infrastructure: Office, industrial, and residential developments, shopping centers, etc. Focus on project management.

Design workshop

Field trip: Bovis Lend Lease construction management firm and tour of Trump Tower construction site. Students MUST wear hard soled shoes.

Design deliverable: Project description, objectives, process plans, assignments, and foci.

Week 3:

Lecture/discussion: Aviation and airport systems.

Design workshop Interim Progress Report # 1 – Project Description

Design deliverable: Criteria and constraints

Field trip: O'Hare redevelopment project office

Week 4:

Lecture/discussion: Highways and bridges.

Design workshop
Field Trip: “Open road tolling” construction and “oasis” reconstruction – Illinois State Toll Highway Authority

Week 5:

Lecture/discussion: Parks and recreational facilities – public systems

Design workshop

Design deliverable: Principle design options

Field trip: Millennium Park

Week 6:

Lecture/discussion: Water and Sewer Treatment and Transport Systems.

Design workshop Interim Progress Report #2 – Design options

Design deliverable: Preliminary (conceptual) design and evaluation

Field trip: Tour of potable water treatment plant

Week 7:

Lecture/discussion: Intercity freight systems

Design workshop

Field trip: Tour of Belt Railroad of Chicago Clearing classification and intermodal yard

Week 8:

Lecture/discussion: Public transportation systems.

Design workshop

Design deliverable: Draft finance and implementation plan

Field trip: Tour Chicago Transit Authority Brown Line rehabilitation project charter
Week 9:

**Lecture/discussion:** Infrastructure finance

**Design workshop**

**Interim Progress Report #3** – Preliminary design & evaluation

**Design Project Workshop** (in lieu of field trip)

Week 10:

**Lecture/discussion:** Ports and Waterways

**Design workshop** – Final draft design projects

**Field trip:** Chicago River architecture tour

Week 11: **Design Project Presentations**

**Schedule:** The course is scheduled to meet Tuesdays, 5:30 to 7:30 p.m., and Fridays, noon until 5:00 p.m. Design workshops will meet Thursdays or Friday mornings at times to be determined.

**Field trip dress and behavior note:**

- Field trips sometimes visit active construction sites. Students must dress appropriately. For outdoor trips, students must always wear substantial, closed shoes, long pants or skirts, and always dress so you can be outdoors for much of the trip. No sandals, running shoes, or open shoes will be permitted. Hardhats will be provided on the first outdoor trip, and students are expected to bring them on every subsequent trip.
- Students must stay with the group on trips. Students who must depart early (to return on their own), or who must slip away from the group, must tell the instructors in advance.
- Students are representing Northwestern University, the McCormick School, and themselves. Appropriate professional respectful behavior is a must.
- If a student misses the bus or train, in either direction, she/he misses the trip. It is permissible to bring food on the bus (not on the train), but
students should make every effort to be neat and courteous. The tour bus may have a restroom onboard, but students should not count on it.

- Students may bring a visitor on the trips, but notify the instructors in advance so it can be determined if space is available, and if so, hardhats can be provided.
- Participants in this course are being given unique access to a variety of infrastructure projects. It is expected that they listen closely, observe carefully, and ask questions.

**Blackboard Web Site** – [https://courses.northwestern.edu/](https://courses.northwestern.edu/)
The course site includes presentation slides, assignments, readings, streaming videos, field trip reports, and student reports of infrastructure in the news. Class slides are normally posted on the site prior to lectures. Items of interest for students are posted either in whole, or by URL

**Infrastructure in the News** - Students are expected to survey print and electronic media for stories concerning infrastructure. They post electronic versions or URL on the Blackboard site under “Communications – Discussion Boards.”