



1.054/1.541 Mechanics and Design of Concrete Structures (3-0-9)

Term Project

Objective

The term project report is intended to encourage you to examine, in some depth, a subject matter in which you are interested. It is also intended to introduce you to the vast body of research and development upon which current design practices are based.

Scope

You are to choose a topic in which you are interested and prepare a project report. A list of some current areas of interest is attached. The subject should then be explored through an examination of the relevant literature. In the report, you should attempt to establish the most current understanding of the basic concepts of physical behavior and/or design concepts related to your specific topic; you should examine the origin of these concepts (including some reference to experimental results where applicable) and their implications to design.

Schedule

There are three documents to be submitted:

1. Project proposal – **February 26** (Thursday)
2. Progress report – **March 30** (Tuesday)
3. Final project report – **May 6** (Thursday)

There will be two progress presentations and one final presentation:

1. Progress presentation I – **March 30** (Tuesday)
2. Progress presentation II – **April 22** (Thursday)
3. Final presentation – **May 6** (Thursday) and **May 11** (Tuesday)

Format

Project Proposal

The project proposal will contain:

1. Title of the research topic
2. Your name and contact information
3. Main text of proposal

Proposal must be typed as singly spaced for text and doubly spaced for section titles. The length of the proposal is limited to **1 page** (Letter size).

Progress Report

The progress report will contain the following components:

1. Title of the research topic
2. Your name and contact information



3. Main text of progress

Progress report must be typed as singly spaced for text and doubly spaced for section titles. The length of the report is limited to **3 pages** (Letter size).

Final Project Report

The final report will consist of the following components:

1. Title Page (1 page)
2. Abstract (1 page).
3. Introduction
4. Main text (sections and subsections)
5. Conclusions
6. Tables and figures
7. List of References

The final report must be typed. Singly spaced for text and doubly spaced for section titles. Length of the text (*Introduction*, main text, *Conclusions*) is limited to **10 pages** (Letter size, not including *Title Page*, *Abstract*, *Tables and Figures*, and *List of References*). You may organize your main text as several main sections with subsections.

Introduction section introduces the topic and its background, defines the objectives of your work and your approach of investigation. The main text explains your methodology of the study and presentation and discussions of the results. *Conclusions* summaries the important findings and structural implications of your investigation. Provide a list of references. All figures, tables, and references should be referred to in the main text.

Papers or books cited as references should be listed by the following format,

Name, "Title", *Journal title/Book title*, Volume No. (for papers), Issue No. (for papers) Publisher (for books), Pages, Date (month, year).

Example:

Buyukozturk, O., "Failure Behavior of Precracked Concrete Beams Retrofitted with FRP," *ASCE Journal of Composites for Construction*, Vol. 2, No. 3, pp. 138-144, August 1998.



Some Topics of Current Research Interest:

- Behavior of fiber reinforced mortar and concrete materials: Study the effect of fiber materials (steel, polypropylene, carbon), fiber content, strain rate, and cyclic loads on the stress-strain response. Characterization of material behavior under tensile, compressive, or flexural loads. Analysis of fracture and failure.
- Behavior and strength of reinforced and prestressed concrete structures and their components. Case studies of an actual bridge. Fracture and finite element analysis. Innovative bridge design methods.
- Constitutive modeling of concrete for finite element analysis. Critical review and comparison of existing models. In-depth study of a specific model. New model development. Finite element implementation.
- Development of computer software for the design and analysis of reinforced concrete or prestressed concrete members and structures. Knowledge based design systems. Expert interactive design development.
- Development of mix design, study of mechanical behavior and application of high strength concrete.
- Behavior of partially prestressed concrete beams. Behavior of unbonded tendons in prestressed segments. Development of design tools for partial prestressing and unbonded tendons.
- Development of innovative structural design methodologies using conventional and advanced construction materials.
- Ceramics and refractories. Behavior of ceramics and refractories, and their uses in structural applications.
- Development and behavior of high performance concrete materials and their use in innovative structural solutions.
- Fracture of cementitious materials and design based on fracture analysis. Interface fracture concepts. Size effects. Composite materials and structural systems.
- Design case studies and design evaluation.
- Durability of concrete structures: corrosion and spalling problems. Bridge deck, roadway, and airport pavement deterioration.
- Nondestructive evaluation (NDE) methods used for condition assessment of concrete structures: ultrasonic, acoustic emission, microwave, and other methods.
- Innovative techniques in repair and strengthening of concrete structures.
- Use of fiber reinforced polymer (FRP) in new construction and in strengthening of existing structures.
- Behavior and design of earthquake resistant concrete structures.
- Repair and retrofit of concrete structures.
- Structural health monitoring (SHM) and damage detection problem in concrete structures.