

The University of Iowa
Department of Civil & Environmental Engineering
CONSTRUCTION MATERIALS 53:130
Spring Semester 1997 Midterm Examination
Prof. C.C. Swan

Answer any 3 of the first four questions

Question #1: (15 points)

- a. What is work-hardening of steel, and why is it used?
- b. Please discuss the potential problems associated with using work-hardened steel.

Question#2: (15 points)

- a. How is the grain structure of steel related to its strength behavior?
- b. How can the grain structure of steel be manipulated to increase the strength of steel?

Question #3: (15 points)

Assume that a steel wharf structure is to be constructed in a saltwater coastal port. Much of the underwater hardware associated with the wharf is to be of brass.

- a. Since both metals are to be submersed in saltwater (electrolytic) in close proximity would you expect the possibility of corrosion problems?
- b. Which metal would you expect to corrode, and why?

Question#4: (15 points)

- a. Briefly, what is the difference between welding and soldering?
- b. Discuss briefly the factors that go into producing high-quality welded steel connections.
- c. What considerations might need to be taken in welding cast iron?

Answer all of the remaining three questions.

Question #5: (20 points)

As part of a major bridge construction project, massive supporting piers approximately 30m tall, and up to 7m in diameter are to be constructed.

- a. Does the **size** of the concrete structural elements present any potential problem with respect to the quality (strength) of the final cured concrete? If yes, please explain.
- b. In terms of the curing process, possible admixtures, and even the concrete mix selection, what special steps might for structural elements of such **large size**?

Question #6: (20 Points)

There are a number of different types of porosity in hardened cement paste (hcp).

- a. Briefly, discuss the different types of porosity;
- b. Which type of porosity is most closely related to the strength behavior of the hcp?
- c. What mix design measures can be taken to reduce this type of porosity?

Question #7: (15 Points)

Discuss the how the following aggregate characteristics can affect the performance behaviors of concrete.

- a. size and gradation;
- b. lightness;
- c. porosity;
- d. chemical composition;
- e. stiffness and strength;