

**53:139 Foundations of Structures**  
**Spring Semester 2009**  
**The University of Iowa**  
**Prof. C.C. Swan**  
**Supplement to Homework Assignment #5**

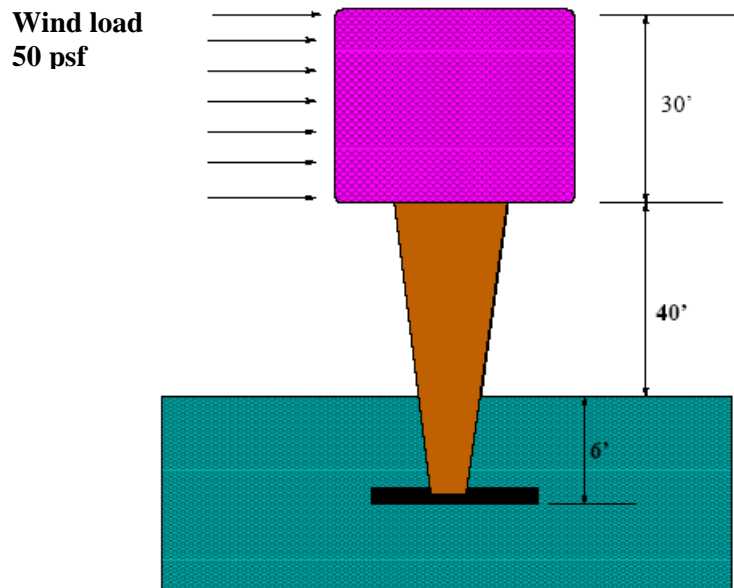
As an engineer working in a general practice design firm, you've been asked to design a foundation system for an elevated 30'x30'x30' water storage tank shown in the Figure below. For the weight of the structure (dead load) use a load factor of 1.4, and for the live loads on the structure from winds, use a load factor of 1.7.

Compute the minimum permissible size of a shallow square footing which will serve as the foundation for the tank such that:

1. A factor of safety against bearing failure of at least 3 is achieved;
2. Under the factored design loads, the settlement of the tank's foundation is no more than one inch;

Notes:

- The soil is granular with a friction angle of  $35^\circ$ , and a unit weight of 120 pcf;
- The depth of the foundation can be taken as 6 ft.;
- Assume that when the 30'x30'x30' tank is full, water constitutes 65% of the total weight of the structure.



**Figure 1:** Schematic of an elevated water tank and its foundation system.