CHAPTER 12
FOUNDATION DESIGN FOR METAL BUILDING SYSTEMS

12.1 INTRODUCTION

Foundations, contrary to the dreams of building owners, do not come prepackaged with metal building systems. The concept of single-source responsibility for pre-engineered buildings is qualified by the fact that the foundations are usually designed by outside engineers.

In this chapter we look into the differences between foundations for metal building systems and those for conventional construction and examine some common solutions. We will not deal with the basics of foundation design, a subject that should be familiar to any practicing structural engineer and, hopefully, to most architects. Similarly, we will not delve into the complex topic of establishing allowable bearing pressures for various soils, a task best left to geotechnical engineers.

As discussed in Chap. 9, poor soils found at the site might call for deep foundations, an expensive item that could explode the project's budget and suddenly make a competing site much more appealing. On a more positive note, an experienced geotechnical engineer might be able to justify a much larger allowable soil-bearing value than could be learned from the necessarily conservative tables of presumptive bearing pressures contained in the building codes. This recommendation could lead to substantial cost savings. As Ruddy[1] has stated, "An increase in an allowable bearing pressure from 3 ksf to 6 ksf can result in a savings of $0.08/s.f. for a shallow spread footing foundation system in a one-story facility."

12.2 SOILS INVESTIGATION PROGRAM

The results of a geotechnical exploration program are of interest to all parties of the construction project. The owner and the local building official need to be reasonably assured that the proposed design can be safely accomplished without endangering the building's occupants and adjoining properties. The engineer of record needs to know soil type, stratification, and water table location to determine the most appropriate foundation type and its bearing depth. The contractor seeks much of the same information to select an excavation support system and to determine dewatering needs. All of the participants are eager to know whether any unsuitable materials such as organic silt or peat are found.

A soils exploration program might uncover a presence of abandoned foundations, buried utilities, and occasionally, an archaeological site. Any one of those "finds" can adversely influence the project's cost and schedule.

Subsurface investigation usually includes several soil borings or test pits, the number, nature, and location of which are determined by the local codes and by experience. The *BOCA National Building Code,*[2] for example, requires at least one soil boring for every 2500 ft^2 of the building area for buildings over 40 ft, or more than three stories, in height bearing on mat or deep foundations. Normal practice calls for one boring at each building corner, one in the center, and the rest, if needed, near