a tendency to expand when excavated, and some soils "bulk" significantly when disturbed. To design a balanced site, the professional needs geotechnical information regarding the soil's character, the bearing capacity of the soil, and its bulking factor, as well as the depth and character of the bedrock. Volumes have traditionally been calculated using a variety of methods and tools such as the average-end method; however, most designers today use a computer to determine volumes.

Site grading proceeds from a conceptual grading plan that attempts to balance the site and to locate the structures or program elements to maximize the site. From the initial design concept, the grading plan undergoes a series of iterations, each one bringing a greater level of detail to the design until the grading plan is final. The final grades adhere to appropriate grading standards (see Table 3.4). In many places grading standards are included in local ordinances and development regulations. Some government agencies and large development companies may have their own standards with which to guide the design. The final grades incorporate concerns for safety, comfort, and access as well as drainage and local concerns such as ice.

## Hillside Developments

Each hillside is unique. The combination of slope, soil, hydrology, geology, vegetation, aspect, and proposed use determines the physical constraints and opportunities for development. In general, it is more expensive to develop a

**TABLE 3.4 Typical Grading Standards**

| | Grading standards | | |
|---|---|---|---|
| Element | Minimum, % | Preferred, % | Maximum, % |
| Lawns | 1.0 | 2–8 | 10 |
| Athletic fields | 1.0 | 1 | 2 |
| Mowed slopes | 5.0 | 10 | 25 (mower safety) |
| Unmowed slopes | — | 25 | Angle of repose |
| Planted slopes | 1.0 | 5 | 10 |
| Berms | 5.0 | 10 | 25 |
| Crown of | — | — | — |
| Unpaved street | 1.0 | 2 | 3 |
| Paved street | 2.0 | 2.5 | 3 |
| Road shoulders | 1.0 | 2–3 | 10 |
| Longitudinal slope of | — | — | — |
| Local streets | 0.5 | 1–10 | 20 |
| Driveways | 0.5 | 1–10 | 20 |
| Parking lots | 0.5 | 2–3 | 20 |