CHAPTER

3

Site Preparation

In preparation for constructing buildings on a property, the builder must consider a number of factors related to code requirements. The buildings must be located according to the approved site plan to meet the requirements of the *International Residential Code* (IRC) and any applicable local ordinances. The soil must be suitable for the support of the building and is factored into the design of the foundations. And the building must be elevated sufficiently and the site graded to provide surface drainage away from the building. The plans examiner considers these factors when checking the construction drawings and site plan, but the inspector will be responsible for verifying the requirements at the jobsite (Figure 3-1).

FIGURE 3-1 Sitework

LOCATION ON PROPERTY

The IRC regulates a building's location on the property primarily to guard against the spread of fire. The code is concerned with not only protecting the new building on the property being developed, but preventing the spread of fire to buildings on the adjacent property. Structural considerations also play a part in locating buildings on a lot. The code regulates distances between the structure and adjacent steep slopes to protect the integrity of the foundation. Local zoning or other ordinances may be more restrictive in regulating the location, height and area of buildings on properties.

Fire separation distance

By definition, fire separation distance (FSD) is measured from the face of the building to the lot line, centerline of a street or alley, or to an imaginary line between two buildings. However, for all practical purposes, fire separation distance typically will be of concern only when measured to the interior lot line. No separation distance or fire resistance rating is required for opposing walls of detached dwellings and accessory structures on the same lot. Fire separation distance is measured at a right angle to the face of the exterior wall (Figure 3-2). **[Ref. R202]**

Provisions that regulate the construction of exterior walls in proximity to lot lines have long been recognized as effective in preventing the spread of fire from a building on one property to a building on another property. Protection can be achieved by providing a clear space between the building and lot line or by using fire-resistant-rated construction. The code does not prohibit placing a building with zero clearance to the lot line provided the exterior wall meets the prescribed fire resistance requirements. When the building is set a certain distance away from the lot line, fire resistance is not required. For dwellings and townhouses protected with an automatic fire sprinkler system, this minimum sepa-

Code Essentials

Exterior walls perpendicular to the wall facing the property line:

- No minimum fire separation distance
- Fire resistance not required
- Unlimited openings
- No protection required for penetrations

ration distance is 3 feet. For dwellings without sprinkler systems and for detached accessory buildings, the minimum separation between the unrated wall and the lot line is 5 feet. (See Chapter 9 for further discussion of fire separation distance and fire-resistant protection of exterior walls.) **[Ref. R302.1]**

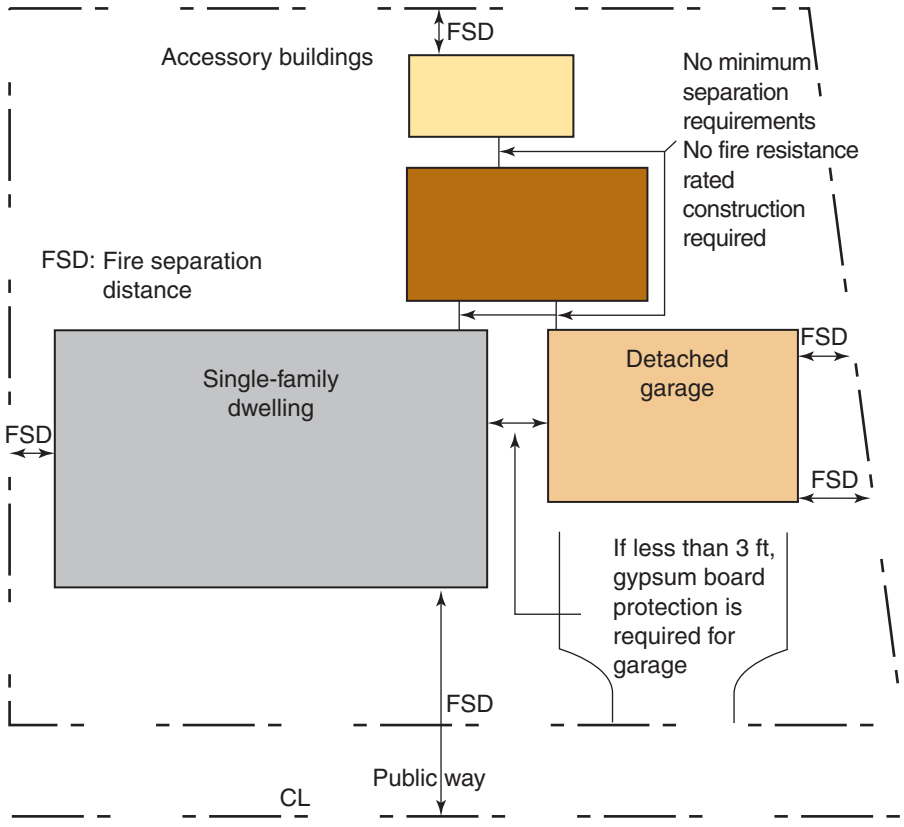

FIGURE 3-2 Measuring fire separation distance

Location of foundations adjacent to slopes

Where slopes are steeper than 33.3 percent (4 inches per foot), foundations must be located a sufficient distance away from the slope to protect the integrity of the structure and provide adequate lateral support to the footing. The clearance distance is based on the height of the slope. For a building located adjacent to the top of the slope (descending), the minimum distance is the height divided by 3, but does not need to exceed 40 feet. For a building located adjacent to the bottom of the slope (ascending), the minimum clearance is the height divided by 2, but does not need to exceed 15 feet. The code gives the building official the authority to approve alternate setbacks with lesser distances to slopes based on a design by a qualified engineer taking all site conditions into consideration (Figure 3-3). **[Ref. R403.1.7]**

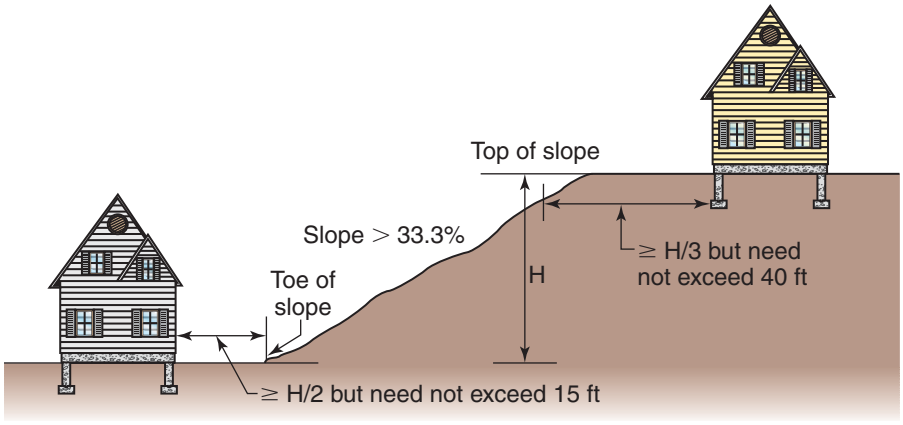

FIGURE 3-3 Foundations adjacent to slopes

SITE PREPARATION

Regulation of site preparation activities related to construction of buildings under the IRC varies based on geographic location and local or site-specific conditions. The code is basically concerned with two things: soil characteristics related to the support and stability of foundations and grading to provide surface drainage away from foundations. Additionally, construction in flood hazard areas must comply with the elevation and design requirements of the IRC or local floodplain regulations. There may also be local or state laws that require grading permits and regulate erosion control, storm water management and soil conservation measures. A number of other factors may affect site preparation and building design, including high water tables and sloped sites.

General site requirements

Preparation of the site for construction includes stripping of vegetation and topsoil, grading to the rough contours if necessary and excavation for basements and foundations. The IRC requires that all exterior footings be placed at least 12 inches below the undisturbed ground level and be protected against frost where applicable. Footings must bear on undisturbed natural soil or compacted engineered fill (covered later in this chapter under "Fill"). The code also prescribes suitable base requirements for basement and garage floors, other slabs on grade and the base for crawl spaces. In all cases, the ground must be stripped of vegetation and organic material. The base for concrete floor slabs within the perimeter walls must be of suitable materials and compacted to prevent settlement. The thickness of compacted fill material below slabs is generally limited to 24 inches for clean sand or gravel and 8 inches for soil unless otherwise approved by the building official (Figure 3-4). **[Ref. R403.1, R408.5, R506.2]**

FIGURE 3-4 Excavation for foundation of a detached dwelling

Soil properties

The designer or builder must carefully consider soil properties not only for adequate support of the foundation but also for stability to prevent future damage to the structure. Based on experience and known local soil conditions, the building official will often permit design based on a presumptive load-bearing value without soil testing or a geotechnical report. Typically, the presumed load-bearing value will range from 1,500 to 3,000 pounds per square foot (psf) based on local soil conditions and according to the values in Table 3-1. The building official may assume conservative values based on the average or the lowest soil characteristics likely to be encountered on a site. Soil type is verified at the time of footing inspection. If found to be of a poorer grade than the presumed value, testing or mitigation is required prior to placing concrete footings.

TABLE 3-1 Presumptive load-bearing values and properties of soils

Unified soil classification system symbol	Soil description	Load-bearing pressure (psf)	Drainage	Frost heave potential	Volume change potential expansion
GW	Well-graded gravels, gravel-sand mixtures, little or no fines	3,000	Good	Low	Low
GP	Poorly graded gravels or gravel-sand mixtures, little or no fines	3,000	Good	Low	Low
SW	Well-graded sands, gravelly sands, little or no fines	2,000	Good	Low	Low
SP	Poorly graded sands or gravelly sands, little or no fines	2,000	Good	Low	Low
GM	Silty gravels, gravel-sand-silt mixtures	2,000	Good	Medium	Low
SM	Silty sand, sand-silt mixtures	2,000	Good	Medium	Low
GC	Clayey gravels, gravel-sand-clay mixtures	2,000	Medium	Medium	Low
SC	Clayey sands, sand-clay mixture	2,000	Medium	Medium	Low
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	1,500	Medium	High	Low
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	1,500	Medium	Medium	Medium to low
CH	Inorganic clays of high plasticity, fat clays	1,500	Poor	Medium	High
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	1,500	Poor	High	High

[Ref. Tables R401.4.1 and R405.1]

The builder always has the option of providing the results of soil testing in a geotechnical report in order to use a higher load-bearing value than would otherwise be presumed. **[Ref. R401.4.1]**

Where available data indicates that the soil may not be suitable for the foundation design, the building official is authorized to require a geotechnical evaluation and report prepared by an approved agency or registered design professional. Expansive, compressible or shifting soils have the potential to damage the structure. Highly organic soils (laden with decayed material from plants and animals), such as organic clays, organic silts and peat, are not included in Table 3-1 and are outside the scope of foundation design under the IRC. In addition to organic materials, certain inorganic clays and silts are highly expansive. Such soils expand when wet and contract as they dry, exerting significant pressures against the footing and foundation and thereby causing shifting or differential settlement that could result in structural failure. Expansive soil conditions require an engineered foundation design in accordance with the *International Building Code* (IBC). In some cases it may be possible to remove unsuitable shifting or compressible soils from the building site and replace them with approved fill to stabilize the soil below and around foundations. Under these conditions, the IRC permits a prescriptive foundation design without a full geotechnical evaluation. **[Ref. 401.4.2]**

Fill

Overexcavation to remove unsuitable soils or the addition of material to raise the elevation of the footings above the level of the natural undisturbed soil requires engineered fill material to support the footings and foundation. A registered design professional is responsible for the design and placement of the fill material in accordance with accepted engineering practice. The engineered fill must be installed and tested in conformance with the design requirements. Fill materials are typically sand, crushed rock, clean gravel or a mix of granular materials. Fill material may contain finer particles that fill voids and help bind the larger elements together. Materials with rounded edges such as river rock or pea gravel are not usually considered suitable for structural fill. The engineer's design specifies the maximum thickness of each layer of fill, called a *lift,* prior to mechanical compaction. A technician tests the compacted fill to verify that it meets the minimum compaction and design specifications. Builders should also exercise care during the backfill of foundations with suitable fill materials to provide adequate drainage and to prevent damage to the foundation. **[Ref. R106.1, R401.2]**

STORM DRAINAGE

The IRC prescribes methods to direct surface water away from the foundation to an approved location. Water held against the foundation leads to wet or damp basements or crawl spaces and over time can cause damage to construction materials both inside and outside the structure. Mold thrives in such moist environments, contributing to an unhealthy

living environment. In addition, water saturation of the soils adjacent to foundations increases the lateral pressure against the structure. Proper design of surface drainage also prevents nuisance ponding on the lot and possible flooding of structures during periods of heavy rain.

The IRC lends some discretion to the building official in determining alternate methods for adequate drainage. Department policy for verifying proper surface drainage on properties will likely vary depending on geographic location, permeability of soils and local history of damage and nuisances created by inadequate drainage. The building official is authorized to require submittal documentation sufficient to demonstrate compliance with the code. If deemed necessary, this may entail a detailed drainage plan with existing and proposed topographic contours, elevations, points of discharge and any containment features. The building official may require that a registered design professional prepare such drainage plans. In many cases, a drainage plan is already established as part of the master plan for the entire housing development and additional plans are not necessary. Other jurisdictions may require only some indication of the direction of drainage flow on the required site plan or may verify drainage on site visually without measurement at the time of inspection (Figure 3-5).

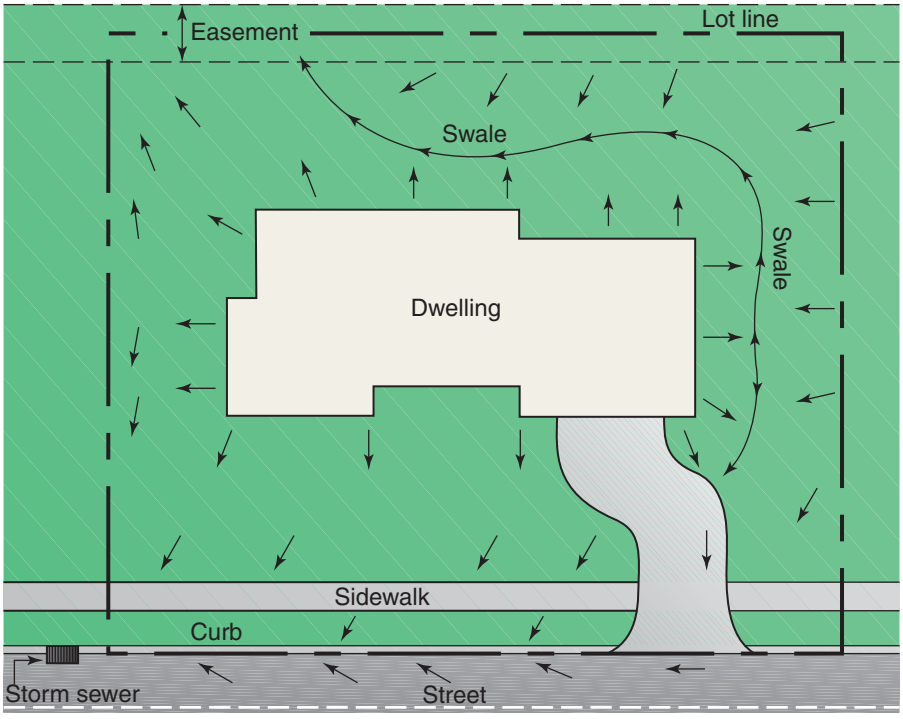

FIGURE 3-5 Drainage plan

The IRC is most concerned with drainage in the immediate vicinity of the structure. The surface of the final grade is required to fall a minimum of 6 inches within the first 10 feet away from the foundation (Figure 3-6). Depending on local site conditions, it is not always possible to achieve that much fall and the code permits alternative designs to drain the water away from the foundation. In this case, the surface water may be directed to swales or drains to ensure adequate drainage away from the structure. Impervious surfaces within 10 feet of the foundation, such as concrete driveways, sidewalks and patios, must be sloped not less than 2 percent away from the structure (Figure 3-7). **[Ref. R401.3, R404.1.6]**

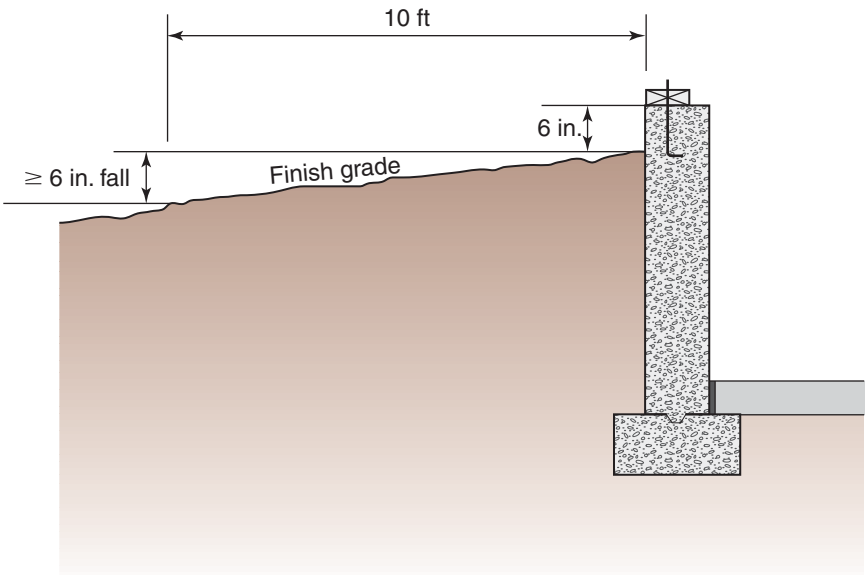

FIGURE 3-6 Grade sloped 6 inches in 10 feet to provide surface drainage away from foundation

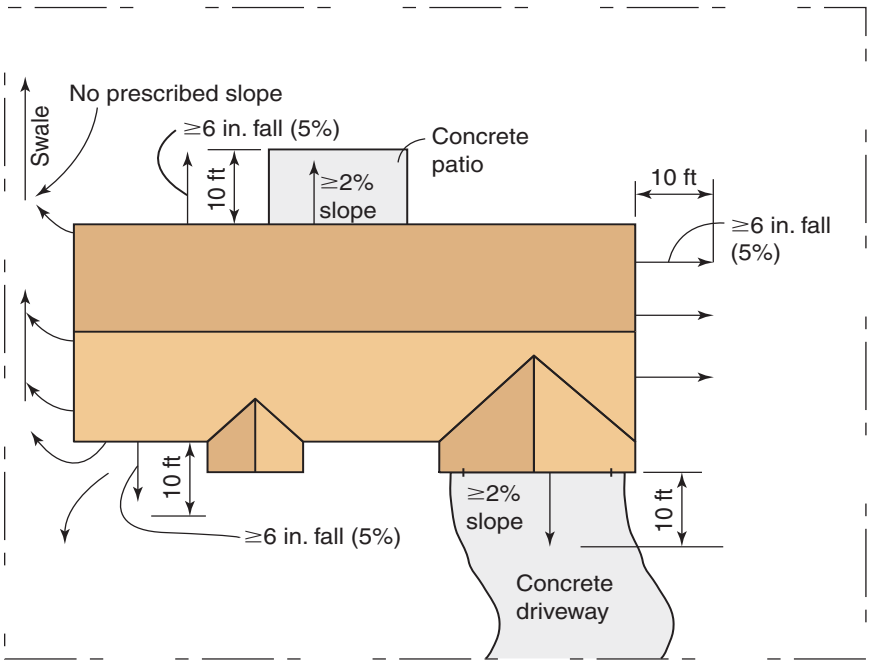

FIGURE 3-7 Grade to ensure surface drainage away from structure