

CHAPTER 20

SITE CLASSIFICATION PROCEDURE FOR SEISMIC DESIGN

20.1 SITE CLASSIFICATION

The site soil shall be classified in accordance with Table 20.3-1 and Section 20.3 based on the upper 100 ft (30 m) of the site profile. Where site-specific data are not available to a depth of 100 ft (30 m), appropriate soil properties are permitted to be estimated by the registered design professional preparing the soil investigation report based on known geologic conditions. Where the soil properties are not known in sufficient detail to determine the site class, Site Class D, subject to the requirements of Section 11.4.4, shall be used unless the Authority Having Jurisdiction or geotechnical data determine that Site Class E or F soils are present at the site. Site Classes A and B shall not be assigned to a site if there is more than 10 ft (3.1 m) of soil between the rock surface and the bottom of the spread footing or mat foundation.

20.2 SITE RESPONSE ANALYSIS FOR SITE CLASS F SOIL

A site response analysis in accordance with Section 21.1 shall be provided for Site Class F soils, unless any of the exceptions to Section 20.3.1 are applicable.

20.3 SITE CLASS DEFINITIONS

Site class types shall be assigned in accordance with the definitions provided in Table 20.3-1 and this section.

20.3.1 Site Class F. Where any of the following conditions is satisfied, the site shall be classified as Site Class F and a site response analysis in accordance with Section 21.1 shall be performed.

1. Soils vulnerable to potential failure or collapse under seismic loading, such as liquefiable soils, quick and highly sensitive clays, and collapsible weakly cemented soils.

EXCEPTION: For structures that have fundamental periods of vibration equal to or less than 0.5 s, site response analysis is not required to determine spectral accelerations for liquefiable soils. Rather, a site class is permitted to be determined in accordance with Section 20.3 and the corresponding values of F_a and F_v determined from Tables 11.4-1 and 11.4-2.

2. Peats and/or highly organic clays [$H > 10$ ft ($H > 3$ m)] of peat and/or highly organic clay where H = thickness of soil.
3. Very high plasticity clays [$H > 25$ ft ($H > 7.6$ m) with $PI > 75$] in a soil profile that would otherwise be classified as Site Class D or E.

EXCEPTION: Site response analysis is not required for this clay category provided that both of the following requirements are satisfied: (i) values of F_a and F_v are

obtained from Tables 11.4-1 and 11.4-2 for Site Class D or E multiplied by a factor that varies linearly from 1.0 at $PI = 75$ to 1.3 for $PI = 125$ and is equal to 1.3 for $PI > 125$; and (ii) the resulting values of S_{DS} and S_{D1} obtained using the scaled factors F_a and F_v do not exceed the upper bound values for Seismic Design Category B given in Tables 11.6-1 and 11.6-2.

4. Very thick soft/medium stiff clays [$H > 120$ ft ($H > 37$ m)] with $s_u < 1,000$ psf ($s_u < 50$ kPa).

EXCEPTION: Site response analysis is not required for this clay category provided that both of the following requirements are satisfied: (i) values of F_a and F_v are obtained from Tables 11.4-1 and 11.4-2 for Site Class E; and (ii) the resulting values of S_{DS} and S_{D1} using the factors F_a and F_v do not exceed the upper bound values for Seismic Design Category B given in Tables 11.6-1 and 11.6-2.

20.3.2 Soft Clay Site Class E. Where a site does not qualify under the criteria for Site Class F and there is a total thickness of soft clay greater than 10 ft (3 m) where a soft clay layer is defined by $s_u < 500$ psf ($s_u < 25$ kPa), $w \geq 40\%$, and $PI > 20$, it shall be classified as Site Class E.

20.3.3 Site Classes C, D, and E. The existence of Site Class C, D, and E soils shall be classified by using one of the following three methods with \bar{v}_s , \bar{N} , and \bar{s}_u computed in all cases as specified in Section 20.4:

1. \bar{v}_s for the top 100 ft (30 m) (\bar{v}_s method).
2. \bar{N} for the top 100 ft (30 m) (\bar{N} method).
3. \bar{N}_{ch} for cohesionless soil layers ($PI < 20$) in the top 100 ft (30 m) and \bar{s}_u for cohesive soil layers ($PI > 20$) in the top 100 ft (30 m) (\bar{s}_u method). Where the \bar{N}_{ch} and \bar{s}_u criteria differ, the site shall be assigned to the category with the softer soil.

20.3.4 Shear Wave Velocity for Site Class B. The shear wave velocity for rock, Site Class B, shall be either measured on site or estimated by a geotechnical engineer, engineering geologist, or seismologist for competent rock with moderate fracturing and weathering. Softer and more highly fractured and weathered rock shall either be measured on site for shear wave velocity or classified as Site Class C.

20.3.5 Shear Wave Velocity for Site Class A. The hard rock, Site Class A, category shall be supported by shear wave velocity measurement either on site or on profiles of the same rock type in the same formation with an equal or greater degree of weathering and fracturing. Where hard rock conditions are known to be continuous to a depth of 100 ft (30 m), surficial shear wave velocity measurements are permitted to be extrapolated to assess \bar{v}_s .