properties and deformation characteristics of the resisting elements in a properly substantiated analysis as indicated in Section 12.8.2. Alternatively, the fundamental period T is permitted to be computed from the following equation:

$$T = 2\pi \sqrt{\frac{\sum_{i=1}^{n} f_i \delta_i^2}{g \sum_{i=1}^{n} f_i \delta_i}} \qquad (15.4\text{-}6)$$

The values of f_i represent any lateral force distribution in accordance with the principles of structural mechanics. The elastic deflections, δ_i, shall be calculated using the applied lateral forces, f_i. Equations 12.8-7, 12.8-8, 12.8-9, and 12.8-10 shall not be used for determining the period of a nonbuilding structure.

15.4.5 Drift Limitations

The drift limitations of Section 12.12.1 need not apply to nonbuilding structures if a rational analysis indicates they can be exceeded without adversely affecting structural stability or attached or interconnected components and elements such as walkways and piping. P-delta effects shall be considered where critical to the function or stability of the structure.

15.4.6 Materials Requirements

The requirements regarding specific materials in Chapter 14 shall be applicable unless specifically exempted in Chapter 15.

15.4.7 Deflection Limits and Structure Separation

Deflection limits and structure separation shall be determined in accordance with this standard unless specifically amended in Chapter 15.

15.4.8 Site-Specific Response Spectra

Where required by a reference document or the authority having jurisdiction, specific types of nonbuilding structures shall be designed for site-specific criteria that account for local seismicity and geology, expected recurrence intervals, and magnitudes of events from known seismic hazards (see Section 11.4.7 of this standard). If a longer recurrence interval is defined in the reference document for the nonbuilding structure, such as liquefied natural gas (LNG) tanks (NFPA 59A), the recurrence interval required in the reference document shall be used.

15.4.9 Anchors in Concrete or Masonry

15.4.9.1 Anchors in Concrete

Anchors in concrete used for nonbuilding structure anchorage shall be designed in accordance with Appendix D of ACI 318.

15.4.9.2 Anchors in Masonry

Anchors in masonry used for nonbuilding structure anchorage shall be designed in accordance with TMS402/ACI 530/ASCE 6. Anchors shall be designed to be governed by the tensile or shear strength of a ductile steel element.

EXCEPTION: Anchors shall be permitted to be designed so that the attachment that the anchor is connecting to the structure undergoes ductile yielding at a load level corresponding to anchor forces not greater than their design strength, or the minimum design strength of the anchors shall be at least 2.5 times the factored forces transmitted by the attachment.

15.4.9.3 Post-Installed Anchors in Concrete and Masonry

Post-installed anchors in concrete shall be prequalified for seismic applications in accordance with ACI 355.2 or other approved qualification procedures. Post-installed anchors in masonry shall be prequalified for seismic applications in accordance with approved qualification procedures.

15.5 NONBUILDING STRUCTURES SIMILAR TO BUILDINGS

15.5.1 General

Nonbuilding structures similar to buildings as defined in Section 11.2 shall be designed in accordance with this standard as modified by this section and the specific reference documents. This general category of nonbuilding structures shall be designed in accordance with the seismic requirements of this standard and the applicable portions of Section 15.4. The combination of load effects, E, shall be determined in accordance with Section 12.4.

15.5.2 Pipe Racks

15.5.2.1 Design Basis

In addition to the requirements of Section 15.5.1, pipe racks supported at the base of the structure shall be designed to meet the force requirements of Section 12.8 or 12.9. Displacements of the pipe rack and