2020 NEHRP PROVISIONS
IT5: NONSTRUCTURAL COMPONENTS

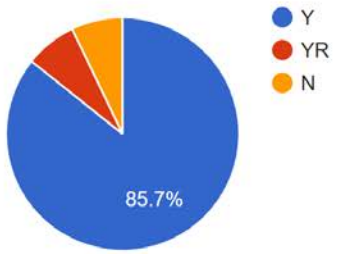
PUC Update
December 2018

MO Ballot Item 16

- Proposed revisions to the scope of the nonstructural requirements intended to clearly identify those components and systems that require seismic design, regardless of whether they are within or supported by building or nonbuilding structure, or if they are supported on grade.

MO Ballot Item 16

Total Voting	Voted	50% Rule	Yes	Yes with Reservations	No	Not Voting	Online Ballot
37	28	Meet	24	2	2	0	Pass



Ehrlich (NAHB) - No

- The proposal needs additional clarity as to what is meant by "permanently attached by mechanical or electrical systems". The intent appears to be to include an external component such as a cooling tower or transformer that provides A/C or electrical power to a building as a "nonstructural component", or an internal component such as a lab bench or other equipment connected to the power or utility systems inside the building.
- However, a building site may have accessory structures on the same site that are served by the same trunk lines as the primary building on the site, but that do not directly contribute to the functionality of the primary building. Under the current scope, such a structure would clearly fall under Chapter 15 as a nonbuilding structure. Under the proposed revisions, someone could consider such a structure "permanently attached by mechanical or electrical systems" and thus a nonstructural component covered by Chapter 13. I don't believe this is the intent.

Ehrlich (NAHB) - No

- Suggested Change: Instead of "to which they are permanently attached by mechanical or electrical systems", suggest using something like "to which they provide mechanical or electrical services, or from which they draw mechanical or electrical services."

Response

- Nonpersuasuive
- A structure would not be considered a nonstructural component.
- Nonstructural components are defined in Chapter 11 as "A part of an architectural, mechanical, or electrical system within or without a building or nonbuilding structure.“
- A component is either in, on, or outside of a building or nonbuilding structure. It is not a building or nonbuilding structure itself.

Kosmatka (PCA) - YR

- The charging paragraph and the provisions are mismatched regarding non-structural components outside of the structure.

Kosmatka (PCA) – Suggested Change

13.1.2 Seismic Design Category.

For the purposes of this chapter, nonstructural components shall be assigned to the same Seismic Design Category as the structure that they occupy, are outside of on the same site, or are supported by, or to the same Seismic Design Category as the structure to which they are permanently attached by mechanical or electrical systems.

Kosmatka (PCA) [redacted] gested Change

13.1.3 Componen[t] Importa[nce] [Fac]r.

All components sh[a]ll be ass[igned a] mponent Importance Factor as indicated in this se[ction]. component Importance Factor, , shall be t[a]ken as 1 [unless] the following conditions apply:

…

3. The compone[nt] is in or attached to supported by a Risk Category IV st[r]ucture, occupies the same site as a Risk Category IV st[r]ucture, or is permanently attached by mechanical or electrical systems to a Risk Category IV structure, and [if] the component is needed for continued operation of the facility or its failure could impair the continued operation of the facility.

[redacted] (PCA) – Su[redacted]

- **[redacted]on C13.1.2 a[redacted]**
- [redacted]ents for nonst[redacted]part on the Se[redacted]y [redacted]ch they are as[redacted] [redacted]onsidering fac[redacted] [redacted]tructural comp[redacted] components [redacted] are assigned to the same SDC as the structure they are located in or supported by, on the same site as, or to the structure to which they are permanently attached by mechanical or electrical systems.

Response

- Nonpersuasive
- We do not believe the charging language and provisions for nonstructural components located outside of a structure are mismatched.
- The proposed addition of the phrase "...are outside of on the same site..." does not add clarity and would exclude components that might not be in the immediate proximity of the structure, such as components that are housed in a central plant. For example, a central plant on a university campus may provide services to a medical center (Risk Category IV) as well as a large number of Risk Category II buildings, and could be located some distance from the buildings they serve.

Nahlawi (ACI) - No

- The changes are acceptable, but I am voting on something that is not coordinated with the previous ballot item, No.15. The proposed changes in ballot No.15 have not been carried forward to this ballot item.
- Suggested Change: Include the changes from item No.15 in item No.16

Response

- Non-responsive
- Each proposal is based on the provisions as they currently exist. When more than one proposal modifies the same section, the changes are merged editorially when the final draft of the provisions is prepared.

Palmer (SEAOCC) - YR

Defining non-structural components as “outside of a structure” is problematic. F_p and design for displacement or drift accommodation in Chapter 13 Nonstructural Components is formulated for components attached to the building. The building will amplify the ground motion and may impart higher accelerations on the non-structural component than if the non-structural component is supported from the ground only. Therefore, non-structural components “outside of a structure” supported separately on the ground are more suited to be designed as a Nonbuilding Structure in Chapter 15.

Palmer (SEAOCC) - YR

- Suggested revision: Require that non-structural components “outside of a structure” supported separately on the ground be designed as a Nonbuilding Structure in Chapter 15.

Response

- Nonpersuasive
- The provisions in Chapter 13 for nonstructural components are applicable to items supported at grade, whether inside or outside of a structure. When components are located at or below grade, the height of point of attachment of the component with respect to the base, z, is taken as 0. This reduces the design force of a component supported at or below grade by a up to a factor of 3 compared to a rooftop component.

Implementation of Force Equation

Existing

$$F_P = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I_p}\right)}\left(1+2\frac{z}{h}\right)$$

F_p is not required to be taken as greater than

$$F_p = 1.6 S_{DS} I_p W_p$$

and F_p shall not be taken as less than

$$F_p = 0.3 S_{DS} I_p W_p$$

Proposed

$$F_p = 0.4 S_{DS} I_p W_p \left[\frac{H_f}{R_\mu}\right]\left[\frac{C_R}{R_{po}}\right]$$

F_p is not required to be taken as greater than

$$F_p = 2.0 S_{DS} I_p W_p$$

and F_p shall not be taken as less than

$$F_p = 0.3 S_{DS} I_p W_p$$

Peak floor versus peak ground acceleration

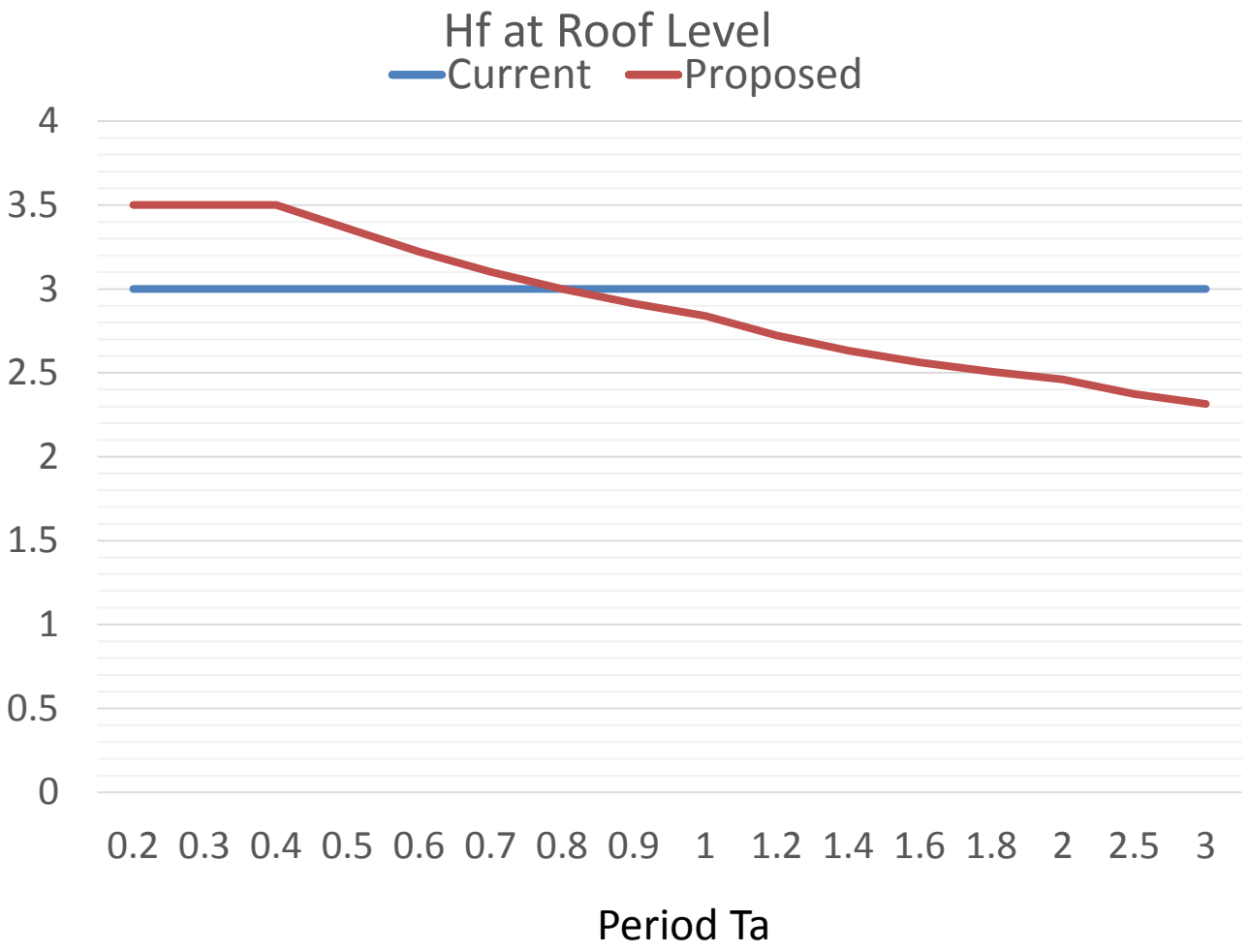
Existing

- (1+2(z/h))
- z=height in structure of point of attachment of component with repsct to the base
- h=average roof height of the structure with respect to the base

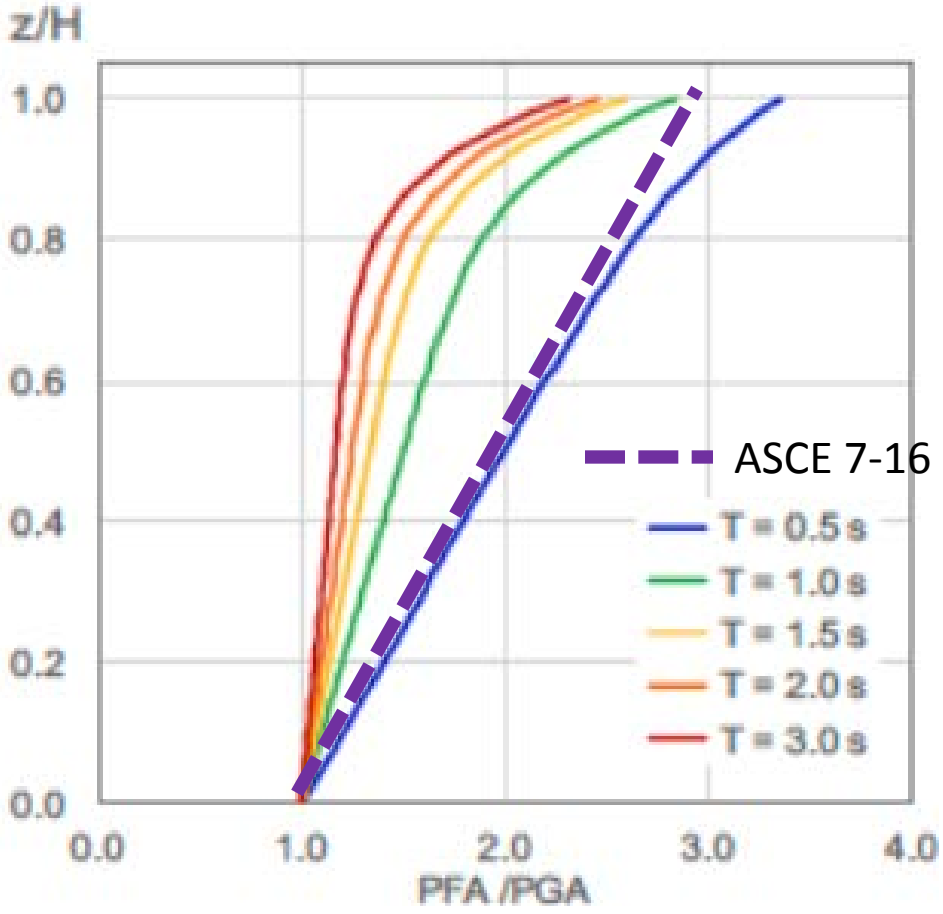
Proposed

- H_f/R_μ
- H_f = a factor that converts the peak ground acceleration into the peak floor (function of approximate fundamental period T_a)
- R_μ= a building ductility reduction factor (function of R and Ω_o)

Peak Roof versus peak ground acceleration - H_f



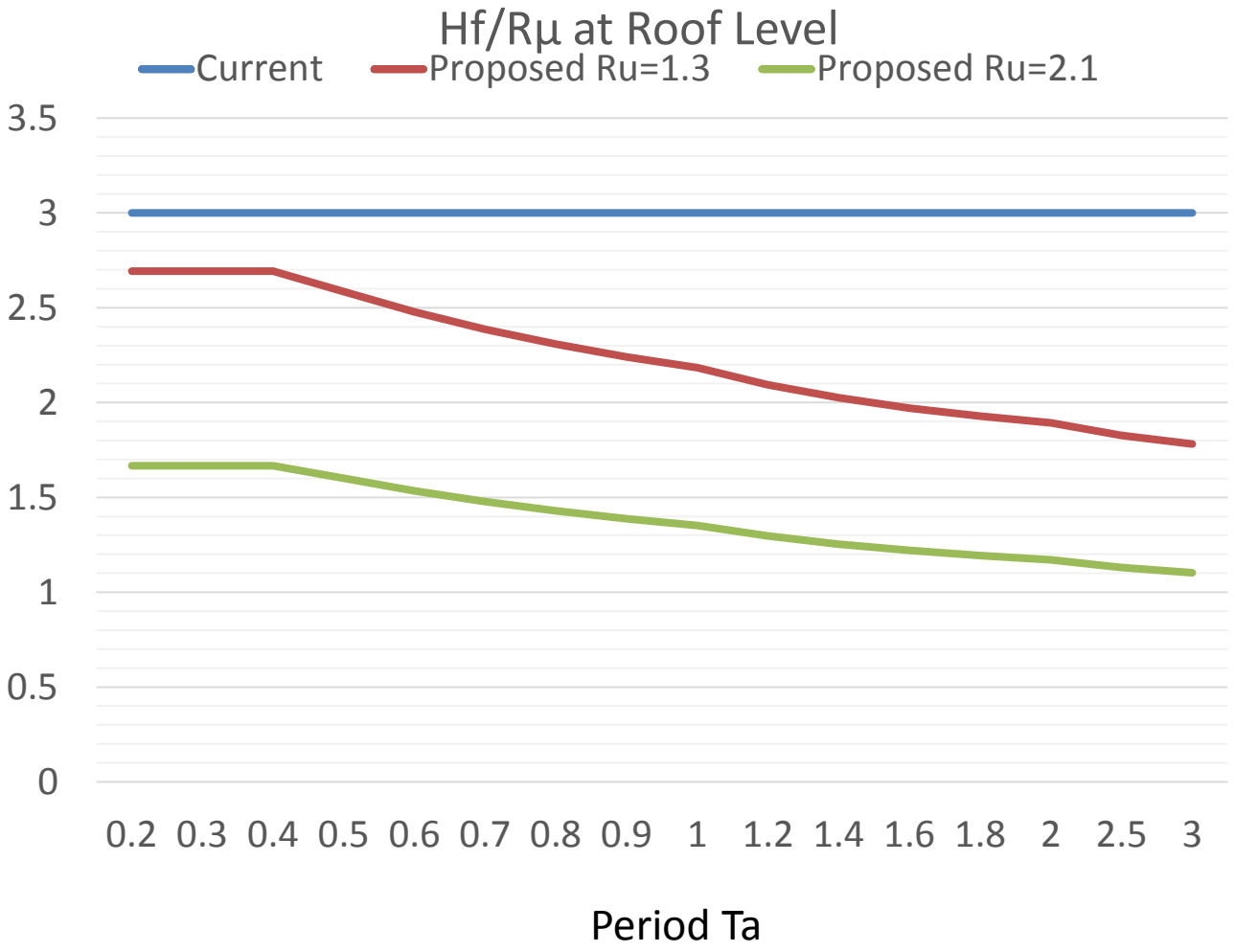
Peak Roof versus peak ground acceleration - H_f



Building global ductility, R_μ

- $R_\mu = (1.1R/\Omega_0)^{1/2}$
- Considering all lateral systems in Tables 12.2-1, 15.4-1, and 15,4-2, R_μ varies from 0.8 to 2.1
- Considering only lateral force resisting systems for buildings that can be used in SDC D and higher, R_μ values generally vary from 1.3 (example OBF) to 2.1 (example EBF)
- Lateral force resisting systems for building that can be used only in SDC C or lower vary from 0.9 to 1.6

Peak Roof versus peak ground acceleration – H_f/R_μ



Component ductility factor, C_R

- Factor to account for component amplification, inherent component damping, and component ductility
- Different values depending on whether the component is supported on a structure or on grade
- Varies from 1.0 to 2.8 for components supported on a structure
- Varies from 1.4 to 2.2 for components supported on the ground

Reserve strength factor, R_{po}

- Reflects inherent overstrength of the component
- Could be component specific or a single value could be used for all components

Tabulated values for components

- Tables 13.5-1 and 13.6-1 are being updated to include the coefficients for the new force formula
- For penthouses, the forces will be determined in Chapter 13 and designed provisions will be in Chapter 15
- Separate entries for pipe bracing and platforms