

# IT-6 Report Nonbuilding Structures

J. G. (Greg) Soules, P.E., S.E.

16 August 2018



# New Proposal IT6-4 (Bachman)

- A new proposal has been developed addressing Bob Bachman's concern on connection design for the steel ordinary concentrically braced frame options listed in Table 15.4-1.
- Proposal basically reduces  $\Omega_0$  for the  $R = 2.5$  option from 2.0 to 1.6.
- Proposal is currently being studied/debated by IT6.

# New Proposal IT6-4 (Bachman)

- Ronald Ziemian (Journal of Constructional Steel Research) asked Carrato and Soules to participate in review of Canadian paper titled “Improved Canadian seismic provisions for steel braced frames in heavy industrial structures”.
- Paper may impact proposal.



# New Proposal on Stiffness Effects of Large Bore Piping

- A proposal is being developed to trigger a coupled analysis when the stiffness of attached piping or interconnected piping exceeds some threshold limit.
- Proposal will predominantly impact Chapter 15 structures.
- Proposal has a ways to go before it is ready for PUC balloting.



# Proposals to be Developed by IT5-IT6 Joint Committee



# Common Components between Chapter 13 and Chapter 15 to be Moved to Chapter 15

- Billboards
- Cooling Towers
- Towers
- Chimneys
- Stacks
- Tanks
- Vessels



# Common Components between Chapter 13 and Chapter 15

- Must add weight exemptions to Chapter 15 similar to those in Chapter 13 so very small components are not required to be designed for seismic (anchorage is still designed for seismic forces).
- Will reference Chapter 13  $F_p$  force equation but use  $R$  values in Chapter 15 for  $R_p$  for nonbuilding structures located up in structures (provision already exists).



# Common Components between Chapter 13 and Chapter 15

- Provisions for tanks and vessels (including small tanks and vessels) are being balloted in the ASCE 7 SSC.
- Other provisions for “small” nonbuilding structures to be developed if needed.
- Cooling towers will require more considerations.



# Penthouses

(except where framed by an extension of the building frame)

- Separate Subsection under Section 15.5 (Nonbuilding Structures Similar to Buildings)
- Lateral Force System limited to moment and braced frame systems (includes ordinary systems) in Table 15.4-1 and wall systems in Table 12.2-1.

# Supports for Nonstructural Components

- Chapter 13 to reference Chapter 15 for support design.
- Supports to use moment and braced frame systems from Table 15.4-1 and wall systems from Table 12.2-1.
- Support design to use R value of support system and not  $R_p$  value of supported component. Forces determined using Chapter 13  $F_p$  equation using R of support as  $R_p$ .

# Proposal IT6-5 (25% Rule)

- Proposal passed with only 2 Yes with Reservation (and I was one of the YR's).
- Ballot responses are as follows.



# Proposal IT6-5 (25% Rule)

- Comments from Lizundia:
- It appears that the implied vertical line in the Hadjian (1986) figure should be at a mass ratio of the supported system to the supporting system at 0.25, not the 0.20 as stated. The ratio of 0.20 is for the mass of the supported system to the total mass which is not how the figure is drawn.
- In addition, the commentary should justify more explicitly how drawing a vertical line at 0.20 on the figure conservatively addresses the situation when the frequency ratio is between about 0.75 and 1.3. This frequency range appears to require a lower mass ratio criterion than 0.20 to achieve the same tolerable error."

# Proposal IT6-5 (25% Rule)

- Proposed responses to Lizundia – Nonpersuasive/Persuasive
- For the first comment, the vertical line in the Hadjian paper would be at a mass ratio of 0.25 as you state. As noted in the commentary, the figure shown is from the original Hadjian paper. The original mass ratio trigger was set at 0.25 in the 1988 UBC and based on a mass ratio definition of the supported system to the supporting system. There is no need to redraw the figure. It is simply included to show where the original trigger came from. Because ASCE 7-02 changed the definition of mass ratio to the mass of the supported system to the total mass, the trigger should have been changed to 0.20 to give the same result as in the Hadjian paper.
- For the second comment, the commentary states that the decision to use a vertical line was based on judgement and the fact that the supporting structure is expected to go nonlinear, which will tend to lessen the effects of resonance and interaction.
- Lizundia to provide editorial additions to commentary.



# Proposal IT6-5 (25% Rule)

- Comments from Soules:
- I mistakenly wrote right when I meant left. Supported NBS need a coupled analysis when the mass ratio falls to the LEFT of the line. The change to the commentary is shown below.
- Combinations of frequency ratio and mass ratio falling to the ~~right~~ left of the curve shown in Figure C15.3-1 would be exempt from a coupled analysis.





# Proposal IT6-5 (25% Rule)

- Proposed response to Soules – Persuasive Editorial
- Oops! Change will be made as requested.
- Revised Proposal IT6-5 Rev 1 uploaded to system.

