Activities of the Practice Committee

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Rutherford and Chekene

NEESR-GC: Simulation of the Seismic Performance of Nonstructural Systems Project meeting

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RUTHERFORD & CHEKENE

NEES Nonstructural

Simulation of the Seismic Performance of Nonstructural Systems

Host Institution

Funded by

Practice Committee

William T. Holmes, SE
- Rutherford & Chekene Consulting Engineers

- **Dennis Alvarez, P. E.**
  - Program Manager, USG Research and Technology Innovation
- **John Gillengerten, SE**
  - OSHPD, Facilities Development Division
- **Russell Fleming**
  - The National Fire Sprinkler Association
- **Praveen K Malhotra, P.E.**
  - Factory Mutual Insurance Company (FM Global)
- **Robert A. Wessel, Ph.D.**
  - Assistant Executive Director, Gypsum Association
- **Don Allen**
  - Steel Stud Manufacturers Association

Practice Committee Charge

- **Participate in the design and performance of experiments**
- **Provide input on simulation tasks**
- **Identify Potential Barriers to Implementation**
- **Identify Key Target Audiences**
  - Subsystem/Component Manufacturers
  - Professional Organizations
  - Code Committees
- **Develop Outreach Programs**
- **Initiate Code Changes**

Partition Variables

- Stud type and gage thickness
- Stud-to-bottom track connection
- Stud-to-top track connection
- Sheathing-to-bottom track connection
- Sheathing-to-top track connection
- Plan geometry (returns, L-Shape, Square box, etc.)
- Continuous and discontinuous partitions
- Bridging channels between studs
- Effect added weights
- Loading direction (in-plane vs out plane)
- Wall-to-ceiling connections

Practice Results from Partition Testing

- No significant input into current practice to date
  - Slip track reduces wall-shear damage but causes corner damage
    - Insufficient resources to test various slip track details
  - Effective “isolation” corner detail
    - Cost effective?
    - Acceptable for fire/acoustical considerations?
  - Insufficient resources to test damage effects on fire ratings
    - Typical top of partition details
    - Shaft wall systems (particularly at corners)
  - Insufficient resources to test light gauge dimpled studs (eg Ultra Steel).
- Significant contribution to catalog of partition fragilities
  - Introduced non-fixed/fixed partitions to ATC 58 (partition damage dominated losses in previous “example” buildings
  - Slip track tops
  - Partial height partitions
- Interaction with ceiling expected to yield practical improved details

Tests on Piping Components

- Practice committee provided input
  - To develop fragilities of piping components for use in analytical models
    - Material and sizes of piping
  - Phase 2 set-up of piping layout
    - Layout and “drop” to ceiling-like restraint
    - Interested in a better understanding--and possibly improvement--of “Restraint of Branch Lines” (following).

2007 NFPA

9.3.6 Restraint of Branch Lines.

9.3.6.1* Restraint is considered a lesser degree of resisting loads than bracing and shall be provided by use of one of the following:

(1) A listed sway brace assembly

(2) A wraparound U-hook satisfying the requirements of 9.3.5.3.9

(3) No. 12, 440 lb (200 kg) wire installed at least 45 degrees from the vertical plane and anchored on both sides of the pipe

(4) Other approved means

(5)*A hanger not less than 45 degrees from vertical installed within 6 in. (152 mm) of the vertical hanger arranged for restraint against upward movement, provided it is utilized such that l/r does not exceed 300, where the rod shall extend to the pipe or have a surge clip installed

9.3.6.2 Wire used for restraint shall be located within 2 ft (610 mm) of a hanger. The hanger closest to a wire restraint shall be of a type that resists upward movement of a branch line.

9.3.6.3 The end sprinkler on a line shall be restrained against excessive vertical and lateral movement.

9.3.6.4* Branch lines shall be laterally restrained at intervals not exceeding those specified in Table 9.3.6.4 based on branch line diameter and the value of C_p.

9.3.6.5 Where the branch lines are supported by rods less than 6 in. (152 mm) long measured between the top of the pipe and the point of attachment to the building structure, the requirements of 9.3.6.1 through 9.3.6.4 shall not apply and additional restraint shall not be required for the branch lines.

9.3.6.6* Sprigs 4 ft (1.2 m) or longer shall be restrained against lateral movement.

Table 9.3.6.4 Maximum Spacing of Branch Line Restraints, (feet)

	Seismic Coefficient, C_p		
Pipe (in.)	C_p <0.50	0.5<C_p<0.71	C_p>0.71
1	45	38	27
1¼	48	40	28
1½	51	43	30
2	55	46	33

ASCE 7—Interaction with ceilings

e. Except where rigid braces are used to limit lateral deflections, sprinkler heads and other penetrations shall have a 2 in. (50 mm) oversize ring, sleeve, or adapter through the ceiling tile to allow for free movement of at least 1 in. (25 mm) in all horizontal directions. Alternatively, a swing joint that can accommodate 1 in. (25 mm) of ceiling movement in all horizontal directions is permitted to be provided at the top of the sprinkler head extension.