Evaluation of Nonlinear Modeling Parameters for Reinforced Concrete Slab-Column Connections

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Experimental Database and Backbone Response

**Force-deformation curve types (adapted from ASCE 41-13)**

Notes:
1. Only secondary component actions permitted between points 2 and 4;
2. The force, Q, after point 3 diminishes to approximately zero.

**Updated Database**
83 reinforced concrete (RC) slab-column (SC) connection specimens
- 69 specimens with bottom slab bars passing through support
- 14 specimens without bottom slab bars passing through support

**Example Type 1 backbone response (Choi et al. 2007)**

Pt. 1: Yield point
Pt. 2: Significant strength degradation begins
Pt. 3: Loss of seismic-force-resisting capacity
Pt. 4: Loss of gravity-load-resisting capacity
Total Drift Ratio to Point 2 ($DR_2$)

**Specimens with continuity reinforcement**

- **ACI 318-14**
- **ASCE 41-13**
- **Mean**
- **Proposed**

69 specimens

**With continuity bars**: proposed $DR_2$ values are approximate mean values

**Specimens without continuity reinforcement**

- **ACI 318-14**
- **ASCE 41-13**
- **Proposed**

14 specimens

**Without continuity bars**: limited data, proposed $DR_2$ values are mean minus one standard deviation for data with continuity reinforcement
Total Drift Ratio to Point 3 ($DR_3$)

**Specimens with continuity reinforcement**

- $DR_3 > DR_2$
- ACI 318-14
- ASCE 41-13
- Proposed

25 specimens

**Specimens without continuity reinforcement**

- $DR_3 > DR_2$
- ACI 318-14
- ASCE 41-13
- Proposed

3 specimens

**With continuity bars**: proposed $DR_3$ values are approximate mean values

**Without continuity bars**: very limited data, proposed $DR_3 = $ proposed $DR_2$
Proposed Nonlinear Modeling Parameter $a$

Generalized force-deformation relation (adapted from ASCE 41-13)

$$\frac{Q}{Q_y}$$

\[ a = DR_a = DR_2 - DR_y \]
\[ b = DR_b = DR_3 - DR_y \]

$a$ and $b$ are highly dependent on the definition of the yield drift

With continuity bars: proposed $a$ values are approximate mean values

Without continuity bars: proposed $a$ values are mean minus one standard deviation for data with continuity reinf.

The proposed parameters are slightly lower than the ASCE 41-13 values.
Proposed Nonlinear Modeling Parameter $b$

**Generalized force-deformation relation (adapted from ASCE 41-13)**

$$\frac{Q}{Q_y} = \frac{1}{1 - DR}$$

$a = DR_a = DR_2 - DR_y$

$b = DR_b = DR_3 - DR_y$

$a$ and $b$ are highly dependent on the definition of the yield drift.

**Specimens with continuity reinf.**

With continuity bars: proposed $b$ values are approximate mean values.

**Specimens without continuity reinf.**

Without continuity bars: very limited data, proposed $b = $ proposed $a$

The proposed parameters are slightly lower than the ASCE 41-13 values.
Today’s Poster Session:

– **Time**: 5:15 – 7:00 pm

– **Room**: Pasadena (Exhibit Hall)

– **Poster location**: **Number 037**