CODE

Table A.9.1—Expected material strengths

Material		Expected strength	
Concrete		$f_{ce}' = 1.3f_c'$[1]	
Reinforcing steel		Expected yield strength, f_{ye}, MPa	Expected tensile strength, f_{ue}, MPa
A615	Grade 420	480	730
A706	Grade 420	475	655
	Grade 550	590	770

[1]Expected strength f_{ce}' is strength expected at approximately 1 year or longer.

COMMENTARY

A.10—Acceptance criteria for deformation-controlled actions

A.10.1 Deformations in any of the response history analyses shall not exceed the ultimate deformation capacity $\boldsymbol{D_u}$ unless (a) or (b) is satisfied.

(a) The analysis assumes the strength associated with this mode of deformation is negligible for the remainder of that analysis, and the structure is evaluated for stability and strength.
(b) The analysis is considered to have an unacceptable response as defined by ASCE/SEI 7.

A.10.2 $\boldsymbol{D_u}$ shall be determined by (a), (b), or (c):

(a) $\boldsymbol{D_u}$ of the component shall be taken as the valid range of modeling as demonstrated by comparison of the hysteresis model with suitable laboratory test data including the appropriate gravity load effect.
(b) If special structural walls are modeled using distributed plasticity (fiber) models, $\boldsymbol{D_u}$ shall be evaluated using the average vertical strain. The strain shall be evaluated over a height of the plastic hinge length, $\boldsymbol{\ell_p}$, where $\boldsymbol{\ell_p}$ is the longer of (i) and (ii):

(i) $\ell_p = 0.2\ell_w + 0.03h_w$ (A.10.2.a)

(ii) $\ell_p = 0.08h_w + 0.022f_y d_b$ (A.10.2.b)

but not exceeding the story height, where $\boldsymbol{d_b}$ and $\boldsymbol{f_y}$ are determined based on the wall longitudinal reinforcement.
(c) If structural components are modeled using lumped plasticity (concentrated hinge) or distributed plasticity (fiber) models, $\boldsymbol{D_u}$ shall be permitted to be in accordance with ACI 369.1M or as substantiated by laboratory testing.

RA.10—Acceptance criteria for deformation-controlled actions

RA.10.1 These acceptance criteria are consistent with the component acceptance criteria in TBI (2017), which are different from those in ASCE/SEI 7 and LATBSDC (2017). More detailed discussion regarding the differences of evaluation approaches of deformation-controlled actions in ASCE/SEI 7 and TBI (2017) are provided in TBI (2017).

RA.10.2 Ultimate deformation capacity, $\boldsymbol{D_u}$, is typically obtained from statistical analysis of the available test data and can be closely related to Collapse Prevention Acceptance Criteria in ACI 369.1M and ASCE/SEI 41. $\boldsymbol{D_u}$ is based on the deformation where substantial loss of gravity load-carrying capacity occurs or, if tests do not progress to this deformation, the limiting deformation for which testing was performed. An example of $\boldsymbol{D_u}$ in the hysteresis curve of an analysis model is shown in Fig. RA.10.2. The Collapse Prevention Acceptance Criteria in ACI 369.1M and ASCE/SEI 41 are typically less than mean experimental values due to scatter in data sets used to develop these criteria. The ASCE/SEI 41 approach also evaluates deformation as the mean of the maximum absolute response from each response history analysis. Appendix A, however, evaluates deformation as the maximum of any of the response history analyses.

Hysteresis behavior of the structural component simulated using fiber material models should be evaluated and adjusted using experimental data for the range of deformation demands and behaviors simulated in the analyses. ACI 374.3R and ACI 369.1M provide nonlinear modeling parameters that can be the basis for hysteresis shape based on experimental data. Figure RA.10.2 shows a hysteresis curve generated using adjusted fiber material models based on such nonlinear modeling parameters to simulate the component behavior observed in laboratory tests.

If $\boldsymbol{D_u}$ is defined by average strain, the length over which strain is defined in the analysis should be consistent with the length over which strain limits are established from experi-