AMERICAN WOOD COUNCIL

September 10, 2020

Elyse Levy, P.E.
Senior Staff Engineer
ICC Evaluation Service

Re: *Proposed Revisions to the Acceptance Criteria for Dowel-type Threaded Fasteners Used in Wood, Subject AC233-1020-R2 (EL/MG/TE)*

Dear Elyse:

We offer the following comments on the proposed revisions to AC233 with numbers keyed to the staff memo:

1) AWC supports the proposed method of testing for recognition of withdrawal from end grain. The inclusion of a delayed withdrawal test after install of the screw is considered necessary to address potential for a reduced withdrawal value associated with a time delay after install.

2) Aspects of testing for recognition of C_{eg}=1.0 for fasteners installed in the edge of CLT is not well described. Care should be exercised to appropriately limit applicability of C_{eg}=1.0 to conditions similar to tested conditions.

3) Because the EU standards are not referenced in the building code, the additional review by ICC-ES staff is necessary to ensure differences in US standards versus EU standards are accounted for in product evaluation. Because of this extra review for use of EU standards, we think it would be preferable for AC233 to recognize the EU standard as an alternative to the US building code reference standards wherever possible.

3b) For added clarity that shear tests of the screw are optional, rearrange sentence 1 of 3.2.1 as follows: 3.2.1 Fastener Strength: ~~Tensile tests and shear~~ Shear tests (optional for fasteners used in wood-to-wood connections only) and tensile tests shall be performed on each combination……*(remainder unchanged)*

Additional comments:

Section 1.3.7. Removal of Technical Report 12 (TR12) will apparently have no effect on current report holders since it is not currently being used. There are conditions where design value benefits accrue from use of TR12 equations over the simplified equations that appear in NDS. As a reference in NDS, we still support TR12 use under AC233.

Thank you for the opportunity to comment.

Sincerely,

Philip Line, P.E.
Director, Structural Engineering
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September 10, 2020

Ms. Elyse G. Levy, S.E.
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Subject: AC233-1020-R2

Dear Ms. Levy;

Please see our comments regarding the proposed changes as given in AC233-1020-R2.

Section 1.3.17 and 1.3.18
In our R1 comment letter, we acknowledged that the named EN standards are consistent with the practice of ASTM D1761 and ASTM D1037. However, they are not ANSI standards and the use may be subject to criticism for that reason.

Section 3.1.2
Using + 6% for the upper boundary is acceptable with statement that the average does not exceed the NDS specification. However, a limitation is not necessary for the lower end of the specific gravity distribution. It is to the proponent's advantage to select wood with a narrow band of specific gravity, and performance variation is controlled by this practice. However, if lower specific gravity wood of the same species group is used, the results simply will tend more conservative. Recommended revision*: Individual wood members shall have specific gravity that does not exceed +6% of the assigned specific gravity for the species combination (2018 NDS, Table 12.3.3A), with the average specific gravity for the wood members used in the test specimens being no greater than the assigned specific gravity for the species combination.*

Section 3.2.1
This section is used to spell out the required strength tests for the fasteners (shear, tension, and bending yield strength) and the calculation of allowable values from the testing data. However, the last sentence is the section is out of place here because it is specific only to lateral load testing. The original purpose for this limitation was only for lateral load testing. In fact, there are some fasteners that are only load rated for withdrawal and pull through and do not need to have a bending or shear strength as those values do not affect the allowable withdrawal load. It is our recommendation that the last sentence is moved to section 4.2.4.5. *Recommended revision: (New section) 4.2.4.5 The average bending yield strength of the test fasteners shall not exceed the specified minimum bending yield strength by more than 10 percent.*

Section 3.3.2
Regarding $E_{eg\text{-}w}$ qualification requirement #2, we commented on this in our R1 letter in an effort to make the provision easier to execute. In retrospect, testing in two wood species combinations that represent the range of specific gravities envisioned for this adjustment factor is entirely adequate. Recommended revision: *For each fastener diameter in a fastener class, test samples shall be investigated using the wood species combinations that represent the maximum and minimum specific gravities (2018 NDS, Table 12.3.3A) that are to be addressed in the evaluation report for the application of this factor.*

Section 3.4.1
One intent of this AC is to ensure the fasteners can meet the performance of the calculated NDS yield limit values. In the current revision of AC233, a proponent tests each fastener diameter and length in each wood main/side member thickness condition to prove the calculated yield limit compliance. This range of conditions produces a range of

allowable loads and wood/fastener limit states. In the proposed revision, the minimum requirement for the entire fastener class is a single test condition. A single test condition may not be adequate because the fastener class can be represented by multiple diameters and bending yield properties. As a result, a single test condition may not be sufficient to assure that the performance of the entire fastener class over a wide range of connection geometries and wood species combinations is represented by the yield limit functions. Recommended revision: *Wood-to-wood connection configurations shall represent one or more typical connections for the longest and shortest fasteners in each diameter of the fastener class.*

Also, in this section, the minimum penetration requirements for partially threaded and fully threaded fasteners are different (D=shank and D=major diameter). For demonstration of compliance with the NDS, we recommend using a single definition of diameter (D) for the test minimum penetration requirements regardless of the thread length (partial or full). Recommended revision: *The fastener penetration into the main member shall be a minimum of 6 times the major thread diameter.*

Section 3.7 and Table 6

The purpose of this AC is to demonstrate that a dowel-type threaded fastener complies with the NDS as much as possible and the intent of the code. For lateral loads, it is not appropriate to seek spacings less than the NDS minimum for loads assigned by section 3.4.1, while reduced minimum spacings could be considered for allowable loads as qualified following section 3.4.2 Recommended revision for section 3.7*: …. Lesser dimensions may be qualified for use in connections addressed in the evaluation report based on initial qualification and subsequent comparative testing following section 3.4.2. ….*

Inasmuch as the intent of AC233 is to demonstrate that threaded-dowel fastener complies with the NDS and the intent of the code, the values in Table 6 should not differ from those of the NDS. Likewise, the NDS does not use specific gravity in the specification of minimum spacing. These comments are reflected in the recommended revisions to Table 6. The recommended Table 6 revisions for end and edge distance are based on a combination of NDS Commentary Table C12.1.5.7 and NDS Section 12.5. However, we left the cells blank related to Between Rows spacings (parallel and perpendicular in main member) because the proposed wording does not fully describe orientation of the members, loading directions, and row layout. Some discussion is needed with Staff to clarify the loading direction with respect to grain orientations of the connection members. Recommended revision for Table 6:

Distance	Load, direction or condition	Minimum Spacing	
		Self-tapping	Pre-drilled
END DISTANCE	Lateral, Tension, parallel toward end	15D	10D
	Lateral, Compression, parallel away from end	10D	5D
	Lateral, Tension or compression, Perpendicular to grain	10D	5D
	Axial (withdrawal or Pull-through)	4D	4D
EDGE DISTANCE	Lateral, Tension or compression, parallel to grain	3D or ½ spacing between rows, whichever is greater	3D or ½ spacing between rows, whichever is greater
	Perpendicular on loaded edge	4D	4D
	Perpendicular not on loaded edge	2D	2D
	Axial (withdrawal or pull-through)	2D	2D
BETWEEN ROWS	Parallel to grain Loading		

(Parallel in Main Member)	Perpendicular to grain Loading		
	Axial (withdrawal or pull-through)		
BETWEEN ROWS (Perpendicular in Main Member)	In-line rows		
	Staggered rows		
	Axial (withdrawal or pull-through)		

Section 4.2.4
The section requires the measurement of connection load and fastener slip. However, the intent actually is to measure lateral movement, and fastener slip is one component of lateral movement. Our recommendation is to revise the first sentence: *4.2.4 Lateral Load Testing: Lateral resistance and movement shall be tested in accordance with ASTM D1761, and the following:*

Figure 3
The load directions for vertical and horizontal need to be added to the figure. Is the terminology the same for each load direction?

ANNEX CB2.0
Our recommendation is that this test should be a consensus standard or a separate criteria so that it can be fully addressed.

The annex is silent about the fastener qualifications for this evaluation. The section must require that the fasteners used for the test of this annex also comply with all of the single fastener tests and other AC233 requirements for dowel-type threaded fasteners. This is a requirement for the practices of AC257 and AC120 and must be a requirement here.

As this test program involves more than two members, it should use the same approach as Annex CA3.3. This would keep the load rating methodologies consistent.

The test assembly needs more description. Having one end resting on a solid surface with an undefined load point, undefined joist span length, and undefined fixity results in an unknown load distribution. Also, as the assembly deforms, perhaps as much as 2 inches, there will be a rotational component that can also affect the test results, and this can be minimized by using a symmetrical assembly.

Furthermore, a test with one fastener per ledger and located as shown in the Figure CB1 will create additional problems. The placement of the test fastener shown in Figure CB1 will almost always result in a cross-grain tension failure of the ledger since the application of load will be at least 80% below the fastener. Designers are prohibited by code to approve a design with this condition. This will also make the determination of deflection irrelevant if the portion of the ledger above the fastener separates from the portion below. Testing two screws per ledger with one above the neutral axis of the ledger and one below the neutral axis of the ledger (as shown in the code illustrations) will be a more rational condition.

Thank you for your consideration of these comments and revisions.

Sincerely,
SIMPSON STRONG-TIE COMPANY INC.
Robert Leichti
Engineering Manager, Fastening

Cc: A. Khachadourian
J. Ellis