AMERICAN LUMBER STANDARD COMMITTEE, INCORPORATED

POLICY FOR EVALUATION OF RECOMMENDED SPANS FOR SPAN RATED DECKING PRODUCTS

November 6, 2020

The Board of Review is authorized to use the information within this policy to approve spans of 16” or 24” for species and decking grades that appear in rules certified by the Board of Review.

A. Introduction

This policy provides a uniform method for assessing span rated decking products which are produced from many different species of wood and graded under several different grading standards. The span rated products are manufactured in sizes from 4/4 to 2" in nominal thickness, and 4" and wider in nominal width. The products are also generally surfaced with large radii at the corners of the cross section.

All of the products are similar in one respect. The products are not assigned the usual array of allowable properties as is the case with other structural lumber grades. Instead, the products are assigned a recommended span rating, usually 16 or 24 inches. The range of current grading rule specifications and species requires the establishment of a uniform common analytical procedure for assessing the appropriateness of these products relative to the recommended spans. This policy establishes such a uniform analytical procedure.

B. Products Covered

This policy applies to lumber 4/4 to 2" in nominal thickness and 4" and wider in nominal width graded as a span rated decking product under a grading rule of an ALSC approved grade rules-writing agency.

C. Species Covered

This policy may be used with any species or species grouping recognized by the ALSC Board of Review.

D. Mechanical Property Data

Input data used in the analysis procedures of this policy shall come from either:

1. Clear Wood Data developed from the procedures of ASTM D2555 and D245.
2. Test data from full sized on-grade (In-grade) lumber as specified in Annex 1.

E. Analysis Procedure for Evaluating Maximum Span Rating

1. Span – Two-span continuous beam condition.
2. Seasoning - Green use condition (MC>19%), assumed to be 23% MC or greater.
3. Section properties - Calculated section properties shall use net surfaced green sizes and shall account for the loss in section due to the radiused corners (see equations below).

$$I_g = \frac{bh^3}{12} \quad \text{(Eqn. 1)}$$

$$I_x = \frac{(9\pi^2 - 84\pi + 176)\, r^4}{144(4 - \pi)} \quad \text{(Eqn. 2)}$$

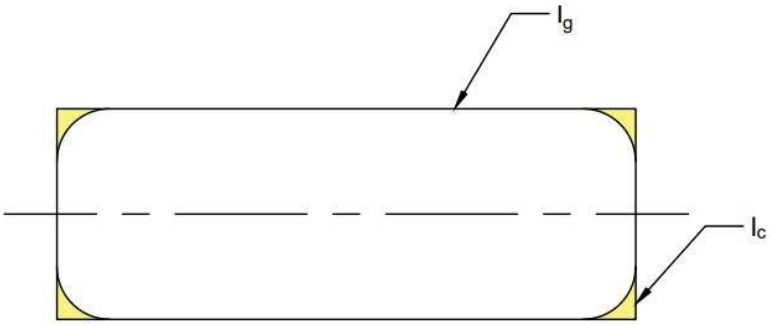
$$A = \left(1 - {}^{\pi}/_{4}\right) r^2 \quad \text{(Eqn. 3)}$$

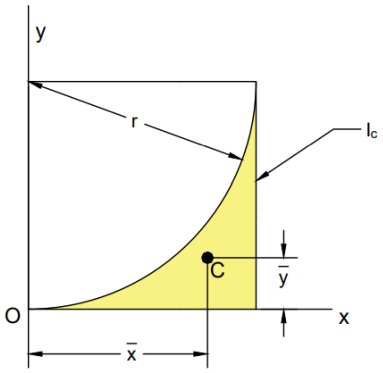
$$\bar{y} = \frac{(10 - 3\pi)\, r}{3(4 - \pi)} \quad \text{(Eqn. 4)}$$

$$d = {}^{h}/_{2} - \bar{y} \quad \text{(Eqn. 5)}$$

$$I_c = I_x + d^2 A \quad \text{(Eqn. 6)}$$

$$I_{rounded} = I_g - 4I_c \quad \text{(Eqn. 7)}$$





4. Adjustments for specimen depth - Properties shall be adjusted to standard surfaced green sizes. Clear wood data from ASTM D2555 shall use the depth adjustment procedures of ASTM D245. In-grade test data shall use the procedures of ASTM D1990.

5. Shear parallel to grain - The calculated allowable shear stress parallel to grain shall equal or exceed the calculated required shear stress for the recommended span. The loads shall not be applied concurrently.
   a. Clear wood data (D2555) used to calculate the maximum allowable shear parallel to grain stress shall utilize the procedures of ASTM D245.
   b. For In-grade test data developed in accordance with Annex 1, the absence of shear failures in the test data shall be deemed sufficient evidence of adequate shear parallel to grain capacity for all approved spans and applicable decking sizes.

6. Bending strength checks – The calculated maximum allowable fiber stress in bending derived from ASTM D2555 and D245, or the In-grade test procedures of Annex 1, shall equal or exceed the stress calculated for the following conditions. The loads shall not be applied concurrently.
   a. Uniform load – 100 psf uniform load applied over both spans of a two-span continuous beam at the recommended span. The analysis shall assume Normal load duration.
   b. Point load – 300 lb point load applied at the mid-point of one span of the recommended span, assuming a two-span continuous beam condition. The analysis shall assume a two-month load duration (DOL = 1.15). Allowable bending stress shall be increased a 10% "boundary condition factor" to account for partial fixity at the reactions caused by the deck-to-joist screw or nail fasteners. The concentrated load shall be applied over an area of 5 in by 5 in, and may be shared 60/40 between two adjacent boards for board widths less than 5 in. (Load sharing factor of 0.6 or higher)

   Note: The 300 lb concentrated load is based on a 220 lb static load multiplied by a dynamic amplification factor of 1.35 to account for expected occupant movements on a deck.

7. Deflection checks – Deflections shall not exceed L / 180, where L is the recommended span for the following conditions. The loads shall not be applied concurrently.
   a. Uniform load – 100 psf uniform load applied over both spans of a two-span continuous beam at the recommended span, using average allowable E.
   b. Point load – 220 lb static point load applied at the mid-point of one span of the recommended span, assuming a two-span continuous beam condition and average allowable E. The concentrated load may be shared 60/40 between two adjacent boards for board widths less than 5 in. (i.e. a Load Sharing Factor of not less than 0.60 is permitted)

8. The calculated maximum recommended spans developed in accordance with this policy may be rounded to the nearest inch when evaluating compliance with the span requirements at either of the two spans specified in this policy (16" or 24"). This policy is not intended to be used for the assessment or approval of decking spans in excess of 24".

9. Report – A report documenting the analysis used by the submitting agency shall be submitted to the ALSC Board of Review for approval. The report shall include full documentation of the analysis procedures used together with the proposed recommended spans. The report shall also include information on the source data, and specimen sampling and testing as appropriate. Any additional considerations of significance to the analysis and any deviations from this policy shall also be reported.

Table1
Analysis Procedure Requirements for Span Rated Decking

Analysis Elements	Criteria
Source Data	Clear Wood (ASTM D2555 & D245) or In-grade test data as described in Annex 1
Design Moisture Condition	Wet Use (assumed 23% MC or greater)
Design Loads (shall not be applied concurrently)	100 psf uniform load over both spans of a two-span continuous beam (strength and deflection checks) 300 lb point load applied on one span of a two-span continuous beam (strength checks) (A 220 lb load increased by a 1.35 dynamic amplification factor) 220 lb point load applied on one span of a two-span continuous beam (deflection check) A Load Sharing Factor of 0.6 or higher shall be used with concentrated loads on deck boards 5” or narrower.
Design Load Duration	Strength Checks: Two-month Duration of Load (DOL = 1.15)
Deflection limit	L/180
Span assumption for analysis	Two-span continuous. For strength checks, a boundary condition factor of 1.1 is permitted for nail/screw attachments.
Bending stress check	Induced bending stress under design load shall not exceed permissible allowable bending stress.
Shear parallel to grain	Induced shear parallel to grain under design load shall not exceed permissible allowable shear parallel to grain stress.
Design Section Properties	1. Based on standard surfaced green sizes. 2. Shall account for section reduction due to radius edges.

Annex 1

Sampling and Testing Protocol for Data Developed
from In-grade Tests of Full-Size Decking Lumber

Terminology - "In-grade testing" is defined as tests of full-size visually-graded solid sawn lumber that is sampled to be representative of the global population being evaluated by grade and size.

A. General

Testing procedures used to develop data for use with the ALSC Policy for Evaluation of Recommended Spans for Span Rated Decking Products shall conform to the requirements and principals of ASTM D4761, except as specifically stated in this annex.

B. Sampling

The basic philosophy of ASTM D1990 should be followed when developing a sampling methodology for this procedure. At a minimum, material shall be sampled to be representative of the grade specification being tested. The sampling methodology utilized shall be fully described in the report.

C. Test Specimens

1. Sample size shall be dependent on the geographical area being represented. ASTM D1990 provides some guidance for determining an appropriate sample size. At a minimum, 240 specimens shall be collected for testing.
2. It is recommended that the test specimens of nominal 5/4 X 6 inches in cross section be used for this test procedure. If cross sectional sizes other than 5/4 X 6 inches are tested, the rationale for the substitution or addition shall be documented in the written submission provided to the ALSC Board of Review.
3. Test specimens shall be at least 6 inches longer than the test span (30 inches long for a 24-inch test span) to permit an overhang of at least 3 inches beyond the support reaction. If a specimen is cut from a longer board, the test specimens shall include the strength reducing characteristic.
4. The following data shall be recorded for each specimen:
    a. Thickness
    b. Width
    c. Length
    d. Moisture content
    e. Maximum size and type of the strength reducing characteristic
    f. Species
    g. Grade

D. Test Equipment

1. Test equipment shall comply with the requirements of ASTM D4761.
2. Test equipment shall be calibrated in accordance with the requirements of ASTM D4761.
3. All pertinent information related to the test machine such as make, model, and calibration procedures shall be included in the test report.

E. Test Procedures

Test procedures shall comply with the following:

1. Rate of loading shall follow the provisions of ASTM D4761.
2. The test span shall be approximately 24 inches. It is recommended that the test machine span be set as close to 24 inches as the machine configuration permits. The test span used shall be documented in the report. If the span used deviates significantly from the recommended span, appropriate justification shall be included in the report.
3. Test specimens shall be loaded normal to the wide face (flatwise) using a point load applied at the mid-point of the test span. A bearing plate may be used between the load source and the test specimen, but it shall not exceed 4 inches in length (measured along the length of the test specimen).
4. Specimens shall be positioned in the test span with the best face up, and the maximum strength reducing characteristic as close to mid span as possible.
5. Load deflection data shall be recorded to permit calculation of specimen modulus of elasticity. The written report shall list the apparent modulus of elasticity (uncorrected for shear). The report may also include additional listings of shear corrected E.
6. Specimens shall be loaded to failure.

F. Data Corrections

1. All data corrections and adjustments shall be fully documented in the report.
2. Data shall be corrected for machine deflection under load if appropriate. All such corrections shall be fully documented.
3. Data shall be adjusted to a common moisture content of 23% by the procedures of ASTM D1990.
4. Test specimens with a moisture content in excess of 23% at the time of testing shall not be adjusted.

G. Output Data

The following data developed from this test procedure shall be used in the analysis of recommended spans.

1. Average apparent E (modulus of elasticity) adjusted to 23% moisture content.
2. Five percent tolerance limit at 75% confidence value of MOR (modulus of rupture) adjusted to 23% moisture content and divided by 2.1. If the test material was proof loaded and a five percent tolerance limit at 75% confidence cannot be determined, the bending stress induced by the highest proof load to which all test specimens were subjected may be substituted for MOR and adjusted to 23% moisture content and divided by 2.1.
3. Report the number of specimens in the test sample which failed in shear parallel to grain, and the calculated shear stress at the failure load.

Table 2
Recommended In-grade Decking Lumber Test Protocol

Test Parameter	Requirement
Sample Size	Consistent with requirements of D1990 Minimum 240 specimens
Lumber tested	Recommended size - 5/4x6 inch nominal Recommended grade - lowest grade to be permitted for the intended span. Other additional sizes and grades permitted
Test span	Recommended - 24 inches Variation from 24-inch span is permitted. Span used must be justified if deviating significantly from 24 inches.
Load configuration	Center point load
Loading rate	In accordance with ASTM D4761
Applied test load required	Test all specimens to failure.
Specimen width and thickness	Full to standard dressed size.
Specimen length	Minimum 30 inch. Specimens may be longer. Specimens cut from longer boards shall be cut in such a manner as to permit proper specimen positioning (with respect to defect location) for testing.
Specimen orientation	Flatwise (load applied normal to wide face).
Specimen positioning	Best face up. Maximum strength reducing characteristic as close to mid span as possible.
Strength assessment	Determine the fifth percentile MOR tolerance limit (divided by 2.1) for the test sample.
Stiffness assessment	Collect load deflection data to permit calculation of apparent MOE for the test specimens. Report all corrections made to test data.
Data Adjustments - General	Fully document and report all corrections and adjustments to the test data.
Data Adjustments – MC	All data shall be adjusted to green moisture condition (23% MC) using the procedures of ASTM D1990. Test specimens above 23% MC at time of test shall not be adjusted to 23%.
Shear parallel to grain	The maximum induced shear stress parallel to grain shall be calculated and reported. Absence of shear failures in the test specimens shall be deemed sufficient evidence of adequate shear capacity for all approved spans.
Application of data	Test data (F_b, E, 5% tolerance limit at 75% confidence MOR/2.1) developed in this test shall be used as input data to the span analysis procedure.