

March 18, 2019

TO: Building Code Enforcement and Design Professionals

FROM: Boise Cascade EWP Engineering

RE: Versa-Lam® LVL: Grade Name Update Utilizing True Modulus of Elasticity

A beam's deflection is dependent upon the modulus of elasticity (MOE) and the member's dimensions. There are two components of deflection: deformation from bending and deformation from shear (typically a much lower value). An "apparent" MOE is typically published for solid sawn lumber products. The apparent MOE is reduced slightly to encompass both deflection components. However a "true" MOE value is published by several manufacturers in the engineered wood industry. True MOE corresponds only to the bending portion of deflection only and thus is "shear-free". A true MOE is approximately 5% higher than the apparent MOE. For example, the true MOE of the new Versa-Lam® LVL 2.1E 3100 grade is 2,100,000 lb/in<sup>2</sup> and the apparent MOE is 2,000,000 lb/in<sup>2</sup>.

Boise Cascade recently changed Versa-Lam® LVL grade nomenclature from apparent to true MOE. The following table provides the existing and corresponding new VERSA-LAM® LVL grade names:

Existing	New	Widths
VERSA-LAM 1.4 1800 DF	Versa-Lam LVL 1.5E 1800 DF	1 5/16"
VERSA-LAM 1.7 2400 DF	Versa-Lam LVL 1.8E 2400 DF	1 1/2", 1 3/4"
VERSA-LAM 1.7 2650 DF	Versa-Lam LVL 1.8E 2650 DF	3 1/2", 5 1/4", 7"
VERSA-LAM 1.7 2650 SP	Versa-Lam LVL 1.8E 2650 SP	1 1/2", 1 3/4", 3 1/2", 5 1/4"
VERSA-LAM 1.8 2750 SP	Versa-Lam LVL 1.8E 2650 SP	3 1/2", 5 1/4"
VERSA-LAM 2.0 2800 DF	Versa-Lam LVL 2.1E 2800 DF	1 1/2", 1 3/4", 2 5/8"
VERSA-LAM 2.0 3100 DF	Versa-Lam LVL 2.1E 3100 DF	3 1/2", 5 1/4", 7"
VERSA-LAM 2.0 3100 SP	Versa-Lam LVL 2.1E 3100 SP	1 1/2", 1 3/4", 3 1/2", 5 1/4"
VERSA-LAM 2.2 3100 DF	Versa-Lam LVL 2.3E 3100 DF	3 1/2", 5 1/4", 7"

Note: "DF" product available in the western US, "SP" product available in the eastern US.

All corresponding previous and new grades shown, with the exception of Versa-Lam® 1.8 SP columns, are the same products having equal design values and thus may be directly substituted for each other. Existing plans, drawings and design reports will remain valid if designed properly; however all should be eventually updated to the new grade names. This will reduce questions from building officials regarding the new product grade stamps. Evaluation report ICC-ES® ESR-1040, revised 03/2019, contains both the previous and new grade names, along with both MOE value types. In addition to the true MOE and bending design values, all 1 1/2" thick Versa-Lam® LVL products will be stamped with their corresponding allowable tension values.

When comparing design reports and allowable load tables of previous and new Versa-Lam® LVL beams, there will be slight differences in deflection results. For longer span applications, new Versa-Lam® grade calculated deflections will be slightly less. For shorter span applications, deflection values may be slightly greater. In these instances, if an original application was designed very close to the deflection limit, there is a chance that the design may be slightly over 100% allowable with the new grade. The new Versa-Lam® LVL product is structurally adequate in this condition, if the original product passed all design controls. Please contact Boise Cascade EWP Engineering for any questions regarding such a condition.

Boise Cascade EWP software will be updated to contain the new Versa-Lam<sup>®</sup> LVL grades and will be available on or near April 1st, 2019, while new technical literature will be published on May 1st, 2019. In the interim, the current Versa-Lam<sup>®</sup> LVL beam grades may be used for analysis. For new Versa-Lam<sup>®</sup> LVL 1.8E SP columns, please refer to Boise Cascade Technical Note LVL-21 for axial load capacities. If using Boise Cascade software to design these columns prior to release of the new database, Versa-Lam<sup>®</sup> LVL 1.8 2750 SP designs shall not exceed 95% of allowable in axial compression-bending and deflection.

When calculating deflection by hand or personal spreadsheet, an engineer must add the shear deflection component to bending deflection when using the higher true MOE. Below are the equations for calculating deflection in a simple span, uniformly loaded beam application:

Deflection using true MOE:  $\Delta_{total} = \Delta_{bending} + \Delta_{shear} = [(5*w*L^4) / (384*E_{true}*I)] + [(12*w*L^2) / (5*E_{true}*b*d)]$   
(The second term of the equation is the shear deformation component)

Deflection using apparent MOE:  $\Delta_{total} = (5*w*L^4) / (384*E_{apparent}*I)$

The following is an example of the calculated deflections for a Versa-Lam<sup>®</sup> LVL beam application:

Beam: 5 1/4" x 16" Versa-Lam<sup>®</sup> LVL 2.1E 3100: I = moment of inertia = 1792 in<sup>4</sup>  
w = total load = 480 lb/ft = 40 lb/in  
L = span length = 20 ft or 240 in

Deflection using true MOE:

$$\Delta_{total} = \Delta_{bending} + \Delta_{shear} = [(5*40*240^4) / (384*2,100,000*1792)] + [(12*40*240^2) / (5*2,100,000*5.25*16)]$$

$$\Delta_{total} = 0.459 \text{ in} + 0.031 \text{ in} = 0.490 \text{ in}$$

Deflection using apparent MOE:

$$\Delta_{total} = (5*40*240^4) / (384*2,000,000*1792) = 0.482 \text{ in}$$

As shown in the preceding example, calculating deflection with either apparent MOE with the bending deformation equation or the true MOE with both the bending and shear deformation components yields a very similar result.

For other loading conditions, shear deflection may be calculated with the following equations:

Cantilever – Uniform Load:  $\Delta_{shear} = [(9.6*w*L^2) / (E_{true}*b*d)]$

Cantilever – Concentrated Load at End:  $\Delta_{shear} = [(19.2*P*L) / (E_{true}*b*d)]$  where P = concentrated load [lb]

Simple Span – Concentrated Load at Mid-Span:  $\Delta_{shear} = [(4.8*P*L) / (E_{true}*b*d)]$

Designers using third party sizing software shall consult with the software provider to ensure the correct method and design properties are being used to calculate deflections. For all further questions, please contact Boise Cascade EWP Engineering at 800.232.0788.