February 21, 2019

RE: Simpson Strong-Tie® Strong-Drive® SDWS Timber Screws to Fasten Wood Structural Panel Single-Surface Splines on CLT Diaphragms

To Whom It May Concern;

Simpson Strong-Tie has evaluated Strong-Drive SDWS Timber Screws (SDWS22400DB and SDWS22600DB) for use in cross-laminated timber (CLT) diaphragm single-surface splines. The SDWS Timber screws are evaluated as an alternate threaded dowel fastener in evaluation report IAPMO-UES ER192.

Testing included static and cyclic tests of CLT panels with shear transfer through plywood single-surface splines. SDWS Timber screw spacing was nominally 4-in. o.c., 6-in. o.c. or 8-in. o.c. The spline material was 1-1/8-in. thick wood structural panel (APA rated Sturd-I-Floor, 48-in. span rating). The CLT panels were in compliance with ANSI/APA PRG 320 and made from either Douglas Fir-Larch (DFL), Spruce-Pine-Fir (SPF), or Spruce-Pine-Fir (South) (SPF-S). The CLT thicknesses of these tests were 3-ply and 5-ply.

The SDWS22400DB may be used in a CLT product with a minimum thickness of 4 in. The SDWS22600DB is to be used in CLT that has a minimum thickness of 6 in. Allowable design values on a single-fastener basis are given in Table 1.

Typical installation is illustrated in Figure 1 and Figure 2. The same number of SDWS Timber screws shall be used to fasten the spline to both diaphragm panels connected by the spline, and the fasteners shall be similarly spaced in both diaphragm panels of the spline connection.

**Design Example**: A diaphragm is designed using CLT panels that require 1100 lb/ft of shear transfer between panels. A single-surface spline is to connect the CLT panels. Given,

- CLT is DFL
- Spline is 1-1/8-in. APA rated Sturd-I-Floor wood structural panel
- $C_M = 1.0$
- $C_t = 1.0$
- $C_d = 1.6$

**Solution:**

$$\frac{1100 \text{ lb}}{375 \text{ lb/screw} \times 1.6} = 1.83 \text{ screws}$$

Therefore, use two (2) SDWS Timber screws per foot spaced 6-in. o.c. on each side of the spline.
Table 1. Reference allowable load and slip modulus for SDWS Timber Screws (SDWS22400DB and SDWS22600DB) for CLT surface spline fastening with 1-1/8-in. APA rated Sturd-I-Floor wood structural panel, single-surface splines.

<table>
<thead>
<tr>
<th>CLT Wood Species Combination</th>
<th>Allowable load per Fastener (lb.)</th>
<th>Fastener slip modulus (in./K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFL</td>
<td>375</td>
<td>0.15</td>
</tr>
<tr>
<td>SPF</td>
<td>335</td>
<td>0.15</td>
</tr>
<tr>
<td>SPF-S</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Allowable loads are given at $C_D=1.0$ and maybe increased up to $C_D=1.6$ as permitted by the building code.
2. Applicable adjustments shall be applied following the ANSI/AWC NDS®-15 or NDS®-18.
3. Design values are applicable for all grain orientation combinations of major strength directions in the CLT and the wood structural panel spline and grades of CLT for the species combinations listed.
4. Designer is responsible to check shear capacity of spline (shear through the thickness and rolling shear).

Figure 1: Typical end elevation -- Single-surface spline with 5-ply CLT panels, 1-1/8-in. spline (plywood shown, 6-in. width), and 6-in. SDWS Timber screws (SDWS22600DB).
Figure 2: Fastener layout plan – Fastener end distance in the spline shall be 1.5±0.25 in, and fastener edge distance in the spline shall be 1.5±0.25 in. The nominal fastener spacing is “X”.

It is permitted to use the basic properties of the SDWS Timber screws from IAPMO UES ER-192 with the CLT and spline material conditions to calculate an allowable shear load and slip modulus. The yield limit equations of the NDS®, section 12.3 will produce more conservative load solutions than the table values, and the calculated slip modulus for dowel-type fasteners in wood-to-wood connections of NDS®, section 11.3.6.1 is less slip per unit load than the table values. The allowable load values of the table may be converted to LRFD by using the format conversion of NDS®, Chapter 11.3.

The information in this letter is valid until 02/10/2021 when it will be re-evaluated by Simpson Strong-Tie. Please visit strongtie.com for additional pertinent information. If you have questions or need further assistance regarding this matter, please contact the Simpson Strong-Tie Engineering Department at 800.999.5099.

Sincerely,

SIMPSON STRONG-TIE COMPANY INC.