January 30, 2019

SunModo Corp.
14800 NE 65th St
Vancouver, WA 98682
Attn: Roland Jasmin

RE: TopTile Wood Deck Mounting Assembly Evaluation

To whom it may concern:

Per your request, Moment Engineering + Design has reviewed recent testing for a new TopTile wood deck mounting assembly system. The TopTile mount system consists of an aluminum stanchion that is secured to the structural plywood of the roof deck with three wood screws and an additional center screw in a tripod fashion. An L-foot bracket is secured to the top portion of the aluminum stanchion with a 3/8” machine bolt. Based on our review of the test data provided on the TopTile mounting assembly, it is our opinion that the assembly can safely support the following design loads under the following conditions:

- Allowable loads listed below consider a safety factor of 2.0 from ultimate load from testing data
- Maximum uplift force shall not exceed 435 lbs.
- Maximum shear force shall not exceed 194 lbs.
- It should be noted that no compressive load (downforce) testing was done at the time of our analysis.
- All connections shall be in accordance with manufacturer’s specifications including required torque, bolts and screws.
- It should be noted that some table values reported in SunModo’s literature may report reaction values exceeding those of the TopTile wood deck mounting assembly. Where this occurs, consult SunModo Corp. for project specific design solutions.

This report does not provide analysis of any existing structures, as may be required by the local authority having jurisdiction. We appreciate the opportunity to have assisted you with this project. Should you have any further questions regarding this analysis, please feel free to contact us by phone or email.

Best Regards,

Shawn P. Kelley, P.E.
Principal
moment ENGINEERING + DESIGN
spkelley@msegllc.com

Reference Document:

September 12, 2017

Mr. Clifford Schrock  
SUNMODO  
14800 NE 65th St.  
Vancouver, WA 98682  

Subject: TopTile™ Wood Deck Mounting System  
Part #K10207-105/107 Laboratory Load Testing

Dear Mr. Schrock:

As requested, Applied Materials & Engineering, Inc. (AME) has completed load-testing the TopTile™ Wood Deck Mounting System (Part #K10207-105/107); see Appendix A, Figure A1. The purpose of our testing was to evaluate the tension (uplift) and shear load capacity of the TopTile™ Wood Deck Mounting System attached to 1/2” Structural I plywood.

SAMPLE DESCRIPTION

Mockup samples were delivered to our laboratory on September 1, 2017. Mockup configuration consisted of a 1/2” Structural I plywood test sample reinforced with a 2”x4” wood frame to minimize the flexing of the plywood. The TopTile™ Wood Deck Mounting System (Part #K102017-105/107) is attached to the plywood using provided product hardware.

TEST PROCEDURES & RESULTS

1. Tensile (Uplift) Load Test

A total of three tests were conducted for tensile (uplift) load capacity on September 7, 2017 using a United Universal testing machine. Samples were rigidly attached to the testing machine and an uplift (tensile) load was applied to the mount. The samples were loaded in tension at a constant rate of axial deformation of 0.10 in. /min. without shock until failure occurred; displacement at maximum load was recorded.

Based on the above testing, the average maximum uplift load of the TopTile™ Wood Deck Mounting System attached to 1/2” Structural I plywood was determined to be 870 lbf. Detailed results are provided in Table I and Figure 1. Test setup and mode of failure are provided in Appendix B, Figure B1.

The specific gravity and moisture content of the plywood were tested in accordance with ASTM D2395, Method A (oven-dry). The average specific gravity and average moisture content of the three samples were determined to be 0.482 and 2.4%, respectively.
2. Shear (Lateral) Load Test Parallel to Rafter

A total of three tests were conducted for shear load capacity on September 7, 2017 using a United Universal testing machine. Samples were rigidly attached to the testing machine and a shear load (parallel to the rafter) was applied to the hook. The samples were loaded in compression at a constant rate of axial deformation of 0.10 in. /min. without shock until failure occurred; displacement at maximum load was recorded.

Based on the above testing, the average maximum shear load of the TopTile™ Wood Deck Mounting System attached to 1/2" Structural I plywood was determined to be 388 lbf. Detailed results are provided in Table II and Figure 2. Test setup and mode of failure are provided in Appendix B, Figure B2.

The specific gravity and moisture content of the plywood were tested in accordance with ASTM D2395, Method A (oven-dry). The average specific gravity and average moisture content of the three samples were determined to be 0.485 and 2.1%, respectively.

Respectfully Submitted,

APPLIED MATERIALS & ENGINEERING, INC.

Joseph Gapuz
Laboratory Manager
TABLE I

TENSILE (UPLIFT) LOAD TEST RESULTS

TOPTILE™ WOOD DECK MOUNTING SYSTEM
(PART #K10207-105/107)

PROJECT NUMBER 1170793C

<table>
<thead>
<tr>
<th>TEST NUMBER</th>
<th>MAXIMUM TENSILE LOAD (lbf)</th>
<th>DISPLACEMENT AT MAXIMUM LOAD (in.)</th>
<th>MODE OF FAILURE</th>
<th>PLYWOOD SPECIFIC GRAVITY</th>
<th>PLYWOOD MOISTURE CONTENT (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>237</td>
<td>919</td>
<td>0.4</td>
<td></td>
<td>0.481</td>
<td>2.1</td>
</tr>
<tr>
<td>238</td>
<td>738</td>
<td>0.4</td>
<td>Wood Screw Pull-out</td>
<td>0.486</td>
<td>2.3</td>
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<tr>
<td>239</td>
<td>953</td>
<td>0.4</td>
<td></td>
<td>0.479</td>
<td>2.7</td>
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<tr>
<td>AVERAGE</td>
<td>870</td>
<td>0.4</td>
<td>..</td>
<td>0.482</td>
<td>2.4</td>
</tr>
</tbody>
</table>

FIGURE 1

K10207-105/107 TENSILE LOAD TEST
Load-Deflection Curve
TABLE II

SHEAR LOAD TEST RESULTS

TOPTILE™ WOOD DECK MOUNTING SYSTEM
(PART #K10207-105/107)

PROJECT NUMBER 1170793C

<table>
<thead>
<tr>
<th>TEST NUMBER</th>
<th>MAXIMUM TENSILE LOAD (lbf)</th>
<th>DISPLACEMENT AT MAXIMUM LOAD (in.)</th>
<th>MODE OF FAILURE</th>
<th>PLYWOOD SPECIFIC GRAVITY</th>
<th>PLYWOOD MOISTURE CONTENT (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>242</td>
<td>349</td>
<td>1.9</td>
<td></td>
<td>0.490</td>
<td>1.9</td>
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<tr>
<td>243</td>
<td>434</td>
<td>1.8</td>
<td>Wood Screw Pull-out</td>
<td>0.486</td>
<td>2.5</td>
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<tr>
<td>244</td>
<td>381</td>
<td>1.7</td>
<td></td>
<td>0.480</td>
<td>2.0</td>
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<tr>
<td>AVERAGE</td>
<td>388</td>
<td>1.8</td>
<td>..</td>
<td>0.485</td>
<td>2.1</td>
</tr>
</tbody>
</table>

FIGURE 2

K10207-105/107 SHEAR LOAD TEST
Load-Deflection Curve

Note: Test 243 conducted with screw configuration shown in Appendix B, Figure B2a. Test 242 & 244 conducted as shown in Appendix B, Figure B2b.
REFERENCES
FIGURE A1

TOPTILE™ WOOD DECK MOUNTING SYSTEM
(PART #K10207-105/107)

PROJECT NUMBER 1170793C

Key Features of TopTile™ Mount System

The TopTile™ Mount System features three mounting options that secure panels 4-7 inches above the tile surface, using stanchions with water-proof sealing washers and moldable flashing. Installers can choose either SunModo’s patented deck mounting system when anchoring into deck or a rafter mounting system. The system can also be mounted to a flat concrete surface. Available Stanchion heights are 5”, 7”; 6” and 8” and can be achieved with 1” spacer.

Rafter Mounting System:
(K10205-005/007)
These Stanchion Mounts can be used for direct rafter installation. Flat tiles allow lateral flexibility to locate the rafter.

Wood Deck Mounting System:
(K10207-105/107)
These Tripod Mounts are used for curved tiles or flat tiles to mount directly into roof decking without removing tiles.

Concrete Deck Mounting System:
(K10290-005/007)
These Stanchion Mounts can be mounted directly to a flat concrete surface with a customer supplied expansion anchor.

Technical Data

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<tr>
<th>Application</th>
<th>Tile Roof</th>
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<tr>
<td>Material</td>
<td>High grade aluminum, 304 stainless steel hardware</td>
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<tr>
<td>Finish</td>
<td>Clear anodized</td>
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<tr>
<td>Flashing Size</td>
<td>9.00 x 12.50 x 0.03 inch</td>
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<tr>
<td>Stanchion Height</td>
<td>5” and 7”; 6” and 8” height can be achieved with 1” spacer</td>
</tr>
<tr>
<td>Roof Attachment</td>
<td>Rafter (wood), decking (wood and concrete)</td>
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<tr>
<td>Structural Integrity</td>
<td>IBC and IRC compliant</td>
</tr>
<tr>
<td>Warranty</td>
<td>20 years</td>
</tr>
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</table>

SunModo, Corp. Vancouver, WA, USA • www.sunmodo.com • 360.844.0048 • info@sunmodo.com
FIGURE B1

TOPTILE™ WOOD DECK MOUNTING SYSTEM
(PART #K10207-105/107)

TENSILE LOAD TEST SETUP

PROJECT NUMBER 1170793C

Figure B1a. Test Setup

Figure B1b. Typical Failure Mode
FIGURE B2

TOPTILE™ WOOD DECK MOUNTING SYSTEM
(PART #K10207-105/107)

SHEAR LOAD TEST SETUP

PROJECT NUMBER 1170793C

Figure B2a. Test Setup (A)

Figure B2b. Test Setup (B)

Figure B2c. Typical Failure Mode