

Agriboard Wall Panel Load Tables

Developed by Armstrong-Douglass Partners, LLC

Methodology Outline

Test Reports and associated raw data utilized for the generation of load tables:

- “AC04 ACCEPTANCE CRITERIA FOR SANDWICH PANELS”, prepared by Omega Point Laboratories, Inc., Project No. 15684-114460 (Rev 1), dated May 29, 2004
 - Raw test data provided to AD Partners on July 14, 2004, via electronic media; filename “Load Tests #114460”, dated October 16, 2003 (Transverse and Axial load test portions only)
- “ASTM E72-98 (Mod) Standard Test Methods of Conducting Strength Tests of Panels for Building Construction”, prepared by Omega Point Laboratories, Inc., Project No. 15684-118441, dated June 7, 2004
- “TRANSVERSE AND AXIAL LOAD TESTS OF STRUCTURAL INSULATED PANELS”, prepared by PFS Corporation, test report #03-62, dated November 10, 2003
 - Raw test data provided to AD Partners on July 14, 2004 via electronic media; filename “0362tab”, dated November 13, 2003

7-7/8” Thick Wall Panels

Fabrication of test panels is according to Agriboard Industries standards utilizing the following materials:

- Each face: 7/16” OSB sheathing, Exposure I, manufactured by Weyerhaeuser, Mill #1013. Strength axis of sheathing is oriented about the weak axis of the panel for 8’ tall panels and about the strong axis of the panel for panels taller than 8’.
- Profile boards: 3-1/2” x 7” Timberstrand LSL engineered lumber manufactured by TrusJoist. Located top and bottom of each panel and each side according to specific tests. Specified for intermediate locations for the tables.
- Panel core consists of two layers of 3-1/2” thick Compressed Agricultural Fiber (CAF). Strength axis of CAF is oriented about the weak axis of the panel.
 - Fabrication of 8’ tall panels for construction utilize the strong axis of CAF oriented about the strong axis of the panel. There are no test results for this configuration so load tables conservatively do not consider the added strength this provides.
- Adhesive used in the CAF manufacturing process and panel assembly process is Ashland Chemical IsoGrip SP3030D.
- Panel fasteners consist of 1-1/4” staples and GRK R4 screws.

Determination of Maximum Allowable Axial Load:

- Per AC04 Acceptance Criteria: allowable load equals the lesser of:
 - Ultimate Load with applied safety factor (3)
 - Load resulting in a net axial deformation of 1/8"
- Axial load tests performed on 8' tall panels include uniform loading and "truss" loading arrangements. The "truss" loading configuration consisted of two simulated truss bearing loads at 2'-0" on center, centered on a four-foot wide panel.
 - Maximum allowable axial loads were determined for uniform loading or 12" on center "truss" loading; 24" on center "truss" loading; and linear interpolation was used to develop allowable loads for 16" on center "truss" loading.
- Axial load tests performed on 24' tall panels utilizing "truss" loading only. The "truss" loading configuration consisted of four simulated truss bearing loads at 2'-0" on center, centered on an eight-foot wide panel.
 - Maximum allowable axial loads were determined for "truss" loading at 24" on center with no increase calculated for loads at 12" or 16" on center due to the lack of test data for these conditions and extrapolation not permitted per AC04 acceptance criteria.

Determination of Maximum Transverse Load:

- Per AC04 Acceptance Criteria: Loads are limited by allowable deflections or the ultimate load with applied safety factor (3). Panels are tested to failure with deflections noted at incremental loads.

Development of Combined Loading Tables:

- The following load tests were utilized:
 - 4'x8' panels with side profile boards (4x8P)
 - 4'x8' panels without side profile boards (4x8)
 - 8'x24' panels with side profile boards (8x24P)
- For 8' panel heights, 4'-3 1/2" and 8'-3 1/2" intermediate profile board spacing was used due to CAF board size and suggested panel construction. For panel heights greater than 8', the panels are fabricated 8'-0" wide. Suggested fabrication options include no intermediate profile boards and one intermediate profile board (centered).
- Conservative, rational combination of results was used to determine maximum allowable axial loads and transverse loads to be used in developing the tables:

- For the 8' panel height with 4'-3 1/2" profile board spacing, results from (4x8P) were combined with results from (4x8) in the following strength reduction ratio:

$$(0.466) * (4x8P) + (0.534) * (4x8)$$

This ratio is calculated based on the spacing of profile boards in a 4'x8' panel versus the spacing of profile boards in a panel constructed with profile boards at 4'-3 1/2" on center.

- For the 8' panel height with 8'-3 1/2" profile board spacing, results from (4x8P) were combined with results from (4x8) in the following strength reduction ratio:

$$(0.241) * (4x8P) + (0.759) * (4x8)$$

This ratio is calculated based on the spacing of profile boards in a 4'x8' panel versus the spacing of profile boards in a panel constructed with profile boards at 8'-3 1/2" on center.

- For the 8' panel height with intermediate profile board spacing that exceeds 8'-3 1/2", the results from the tests without side profile boards (4x8) were used.
- For the 24' panel height, the test results (8x24P) were used without reduction with the exception of the removal of the panel self-weight from the axial load test results. This is due to the configuration of the testing apparatus, which is situated horizontally and not allowing for the panel weight to be a factor. There were no tests performed on panels greater than 8' tall with intermediate profile boards, therefore, these same maximum values were used for 8'-wide x 24'-high panels with an intermediate profile board.

- The following interaction equation was used in compliance with AC04 to determine the allowable axial loads at incremental transverse loads:

$$f_a/F_a + f_b/F_b = 1$$

where f_a = allowable axial load

F_a = maximum axial load capacity

f_b = transverse load at table increments

F_b = maximum transverse load capacity

- For panel heights between 8' and 24', linear interpolation was used to create the table values.
 - To enable interpolation, new values were calculated for 8' tall panels as if they were constructed in 8' widths. This sets up

interpolation between 8' tall and 24' tall panels that are constructed the same way.

- For the 8' panel height with no intermediate profile board, results from (4x8P) were combined with results from (4x8) in the following strength reduction ratio:

$$(0.5) * (4x8P) + (0.5) * (4x8)$$

This ratio is calculated based on the spacing of profile boards in a 4'x8' panel versus the spacing of profile boards in an 8'-wide panel constructed with side profile boards only.

- For the 8' panel height with one intermediate profile board, results from (4x8P) were combined with results from (4x8) in the following strength reduction ratio:

$$(0.75) * (4x8P) + (0.25) * (4x8)$$

This ratio is calculated based on the spacing of profile boards in a 4'x8' panel versus the spacing of profile boards in an 8'-wide panel constructed with side profile boards and an intermediate profile board.

Determination of Maximum Allowable Shear Load:

- Two racking shear tests were performed. The first test was performed on an 8'x8' panel. The second test was performed on an 8'x8' panel with an intermediate panel joint at 4'. Per AC04 acceptance criteria, the maximum allowable load equals the lesser of:
 - Ultimate Load with applied safety factor (3)
 - Load resulting in a net horizontal deflection of 1/2"
- The first test was deemed not acceptable by ICC so the second test was performed. Both tests were analyzed, however, per AC04 acceptance criteria with the lesser of the two values included in the load tables.
 - The 8'x8' panel test without an intermediate joint was controlled by the horizontal deflection limit.
 - The 8'x8' panel with an intermediate joint was the controlling test and was limited by the ultimate failure load.

4-3/8" Thick Wall Panels

Fabrication of test panels is according to Agriboard Industries standards utilizing the following materials:

- Each face: 7/16" OSB sheathing, Exposure I, manufactured by Weyerhaeuser, Mill #1013. Strength axis of sheathing is oriented about the weak axis of the panel for 8' tall panels.
- Profile boards: 3-1/2" x 3-1/2" Timberstrand LSL engineered lumber manufactured by TrusJoist. Located top and bottom of each panel and each side according to specific tests. At spacings specified for the tables, intermediate profile boards will be 1-3/4" x 3-1/2".
- Panel core consists of a single layer of 3-1/2" thick Compressed Agricultural Fiber (CAF). Strength axis of CAF is oriented about the weak axis of the panel.
 - Fabrication of 8' tall panels for construction utilize the strong axis of CAF oriented about the strong axis of the panel. There are no test results for this configuration so load tables conservatively do not consider the added strength this provides.
- Adhesive used in the CAF manufacturing process and panel assembly process is Ashland Chemical IsoGrip SP3030D.
- Panel fasteners consist of 1-1/4" staples and GRK R4 screws.

Determination of Maximum Allowable Axial Load:

- Per AC04 Acceptance Criteria: allowable load equals the lesser of:
 - Ultimate Load with applied safety factor (3)
 - Load resulting in a net axial deformation of 1/8"
- Axial load tests performed on 8' tall panels include uniform loading and "truss" loading arrangements. The "truss" loading configuration consisted of two simulated truss bearing loads at 2'-0" on center, centered on a four-foot wide panel.
 - Due to irregularities in the test data, the "truss" loading tests were exclusively used in the development of the load tables. This was due to unusually low results from the uniform load test. Speaking with a representative of the testing agency, Omega Point Laboratories, it was discovered that these low values were the result of non-uniform bearing in the uniform load test, resulting in local deformations that resulted in failure of the panel (1/8" maximum allowable).

Determination of Maximum Transverse Load:

- Per AC04 Acceptance Criteria: Loads are limited by allowable deflections or the ultimate load with applied safety factor (3). Panels are tested to failure with deflections noted at incremental loads.

Development of Combined Loading Tables:

- The following load test results were utilized:
 - 4'x8' panels with side profile boards (4x8P)
 - 4'x8' panels without side profile boards (4x8)
- For 8' panel heights, 4'-1 3/4" and 8'-1 3/4" intermediate profile board spacing was used due to CAF board size and suggested panel construction.
- Conservative, rational combination of results was used to determine maximum allowable axial loads and transverse loads to be used in developing the tables:

- For the 8' panel height with 4'-1 3/4" profile board spacing, results from (4x8P) were combined with results from (4x8) in the following strength reduction ratio:

$$(0.241) * (4x8P) + (0.759) * (4x8)$$

This ratio is calculated based on the size and spacing of profile boards in a 4'x8' panel versus the size and spacing of profile boards in a panel constructed with profile boards at 4'-1 3/4" on center.

- For the 8' panel height with 8'-1 3/4" profile board spacing, results from (4x8P) were combined with results from (4x8) in the following strength reduction ratio:

$$(0.123) * (4x8P) + (0.877) * (4x8)$$

This ratio is calculated based on the size and spacing of profile boards in a 4'x8' panel versus the size and spacing of profile boards in a panel constructed with profile boards at 8'-1 3/4" on center.

- For the 8' panel height with intermediate profile board spacing that exceeds 8'-1 3/4", the results from the tests without side profile boards (4x8) were used.

- The following interaction equation was used in compliance with AC04 to determine the allowable axial loads at incremental transverse loads:

$$f_a/F_a + f_b/F_b = 1$$

where f_a = allowable axial load

F_a = maximum axial load capacity

f_b = transverse load at table increments

F_b = maximum transverse load capacity

Determination of Maximum Allowable Shear Load:

- Two racking shear tests were performed. The first test was performed on an 8'x8' panel. The second test was performed on an 8'x8' panel with an intermediate panel joint at 4'. Per AC04 acceptance criteria, the maximum allowable load equals the lesser of:
 - Ultimate Load with applied safety factor (3)
 - Load resulting in a net horizontal deflection of 1/2"
- The first test was deemed not acceptable by ICC so the second test was performed. Both tests were analyzed, however, per AC04 acceptance criteria with the lesser of the two values included in the load tables.
 - The 8'x8' panel test without an intermediate joint was the controlling case with the allowable load set by the horizontal deflection limit.
 - The 8'x8' panel with an intermediate joint was controlled by the ultimate failure load.