

CSI: 06 12 00 PRODUCT: Structural Insulated Panels (SIPs) DIVISION: Wood and Plastic SECTION: Structural Panels



Report Holder Net Zero SIPS LLC 8805 Stoney Cap Road Jefferson City, MO 65010

Manufacturing Location(s)

Net Zero SIPS LLC 8805 Stoney Cap Road Jefferson City, MO 65010

1. SUBJECT

1.1. Structural Insulated Panels. Wall and Roof Panels 8 ft to 24 ft long, 4-1/2 in. to 6-1/2 in. thick.

2. SCOPE

NTA, Inc. has evaluated the above product(s) for compliance with the applicable sections of the following codes:

- 2.1 2012, 2015 International Building Code (IBC)
- 2.2 2012, 2015 International Residential Code (IRC)

NTA, Inc. has evaluated the above product(s) in accordance with:

2.3 NTA IM 014 Structural Insulated Panel Evaluation

2.4 NTA IM36 Quality System Requirements

NTA, Inc. has evaluated the following properties of the above product(s):

2.5 Structural performance under axial, transverse and inplane shear loads.

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3. USES

3.1 General. *Net Zero SIPS LLC Building Panels* are used as structural insulated wall and roof panels.

3.2 Construction Types. *Building Panels* shall be considered combustible building elements when assessing construction type in accordance with 2015 IBC Chapter 6. ^(IM 014 NACU1)
3.3 Fire Resistive Assemblies. *Net Zero SIPS LLC Building Panels* shall not be used as part of a fire-rated assembly unless suitable evidence and details are submitted and approved by the authority having jurisdiction. ^(IM 014 ACU14)

4. **DESCRIPTION**

4.1 General. *Building Panels* are factory-assembled, engineered-wood-faced, structural insulated panels (SIPs) with polyurethane foam plastic core. The panels are intended for use as load-bearing or non-load bearing wall and roof components. Panels are available in 4-1/2 in. and 6-1/2 in. overall thicknesses. The panels are custom made to the specifications for each use and are assembled under factory-controlled conditions. The maximum panel size is 8 ft wide and up to 24 ft in length.

4.2 Header Beams. Net Zero SIP Headers are assembled in the same manner as the wall and roof panels. The headers are 4-1/2-in. thick and range in length from 4-ft to 7.5-ft long. The header facing material is oriented such that the strength axis of the OSB is in the direction of the header span. The top and bottom plates are #2 SPF 2 x 4 nominal lumber. The ends of the headers have vertical block splines. **4.3** Materials.

4.3.1 **Facing.** The facing consists of two single-ply oriented strand board (OSB) facings a minimum of 7/16 in. thick complying with DOC PS 2, Exposure 1, Rated Sheathing with a span index of 24/16 and 2015 IRC Table R610.3.2. Panels shall be manufactured with the facing strength axis oriented parallel to the direction of SIP bending. ^(IM 014 ACU4)

4.3.2 **Core.** The polyurethane core material is minimum 2.2 pcf density which is foamed in place and self-adhering to the facing. The foam plastic core has a self-ignition temperature of 650 °F or greater when tested in accordance with ASTM D1929. The foam core has a flame spread rating not exceeding 75 and a smoke-developed rating not exceeding 450 in compliance with 2015 IBC Section 2603.3 Exception 4.

4.4 Material Sources. The facing and core materials used in the construction of *Net Zero SIPS LLC Building Panels* shall be composed only of materials from approved sources as identified in the in-plant quality system documentation.

5. DESIGN

5.1 Overall Structural System. The scope of this report is limited to the evaluation of the SIP component. Panel connections and other details related to incorporation of the panel in the overall structural system of a building are beyond that scope of this report and are the responsibility of the designer of record. (IM 014 NACU3)

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5.2 Design Approval. Where required by the authority having jurisdiction, structures using *Net Zero SIPS LLC Building Panels* shall be designed by a registered design professional. Construction documents, including engineering calculations and drawings providing floor plans, window details, door details, and connector details, shall be submitted to the code official when application is made for a permit. The individual preparing such documents shall possess the necessary qualifications as required by the applicable code and the professional registration laws of the state where the construction is undertaken. Approved construction documents shall always be available on the jobsite during installation. ^(IM 014 NACU4)

5.3 Design Loads. Design loads to be resisted by the SIPs shall be as required under the applicable code. Loadings on the panels shall not exceed the loads noted in this report. Where loading conditions result in several modes of superimposed stressing, the sum of the ratio of actual loads over allowable loads shall not exceed one. Calculations demonstrating that the loads applied are less than the allowable loads described in this report shall be submitted to the code official for approval. ^(IM 014 NACU5)

5.4 Allowable Loads. Allowable axial, transverse, and inplane shear loads may be calculated using the panel properties provided in Tables 1 and 2 or selected from Tables 3 through 6. For loading conditions not specifically addressed herein, structural members designed in accordance with accepted engineering practice shall be provided to meet applicable code requirements.

5.5 Concentrated Loads. Axial loads shall be applied to the product through continuous members such as structural insulated roof or floor panels or repetitive members such as joists, trusses or rafters spaced at regular intervals of 24-in. on center or less. Such members shall be fastened to a rim board or similar member to distribute the load to the product. For other loading conditions, reinforcement shall be provided. This reinforcement shall be designed in accordance with accepted engineering practice. ^(IM 014 ACU12)

5.6 Eccentric and Side Loads. Axial loads shall be applied concentrically to the top of the panel. Loads shall not be applied eccentrically or through framing attached to one side of the panel (such as balloon framing) except where additional engineering documentation is provided. (IM 014 ACU13)

5.7 Openings. Openings in panels shall be reinforced with wood or steel designed in accordance with accepted engineering practice to resist all loads applied to the opening as required by the adopted code. Details for door and

window openings shall be provided to clarify the manner of supporting axial, transverse and/or racking shear loads at openings. Such details shall be shown on approved design documents and subject to approval by the local authority having jurisdiction. ^(M 014 ACU8) Unreinforced openings may exist where the spans, uniform loads and deflection limits provided in Table 5 meet or exceed the design requirements.

5.8 In-Plane Shear Design. Shear walls shall be sized to resist all code required wind and seismic loads without exceeding the allowable loads provided in Table 6. Shear wall chords, hold-downs and connections to transfer shear forces between the wall and surrounding structure shall be designed in accordance with accepted engineering practice. (IM 014 ACU17) Allowable strengths for SIP shear walls with structural splines along each panel edge shall be designed in accordance with accepted engineering practice and are subject to the limitations for wood sheathed shear walls.

5.9 Seismic Design. Use of panels as shear walls (racking shear) is limited to structures in Seismic Design Categories A, B and C. Where panels are used to resist seismic forces, the following factors shall be used for design: Response Modification Coefficient, R = 2.0; System Overstrength Factor, $\Omega_{\theta} = 2.5$; Deflection Amplification Factor, $C_d = 2.0$. (M 014 ACU16) The maximum panel height-to-width ratio shall be 2:1. (M 014 ACU17)

6. INSTALLATION

6.1 General. *Net Zero SIPS LLC Building Panels* shall be fabricated, identified and erected in accordance with this report, the approved construction documents and the applicable codes. In the event of a conflict between the manufacturer's published installation instructions and this report, this report shall govern. Approved construction documents shall always be available on the jobsite during installation. (IM 014 NACU7)

6.2 Splines. Net Zero SIPS LLC Building Panels are connected to each other at the panel edges through the use of a tongue-and-groove spline arrangement. There are 2 configurations used for the tongue portion of the connection.

6.2.1 **Block Splines** are manufactured in the same manner as the Structural Insulated Panel except with an overall thickness that is 1-in. less than the overall thickness of the panels to be joined. *Net Zero* uses 7/16 in. x 1-1/2 in. x 16-gauge staples spaced a maximum of 6 in. on-center to hold a block spline in place. Block splines fastened with staples have not been evaluated for their contribution to lateral force resistance systems (shearwalls).

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6.2.2 **Lumber Splines** consist of 1 or more plies of dimensional lumber sized to fit inside the facings of the Structural Insulated Panel. The lumber extends 1-1/2-in. into each panel being joined and is fastened in place using 0.113-in. x 2-in. Bright Basic Smooth Shank nail. 4-in. on center with a 3/4-in. edge distance on the facings. Wall panels intended to be used as part of a lateral force resistance systems as described in Section 5.8 and in Table 6 require the use of lumber splines. Connections using dimensional lumber splines not specifically addressed in this report must be designed in accordance with accepted engineering practice to meet applicable code requirements.

6.3 Plates. The top and bottom plates of the panels shall be dimensional or engineered lumber sized to match the core thickness of the panel. The plates shall be secured in place using 7/16 in. x 1-1/2 in. x 16-gauge staples at a maximum of 6 in. on-center or an approved equivalent fastener. Top and bottom plates in wall sections intended to be used as part of a lateral force resistance system shall be fastened using 0.113-in. x 2-in. Bright Basic Smooth Shank nail. 4-in. on center as described in Table 6.

6.4 Cutting and Notching. No field cutting or routing of the panels shall be permitted except as shown on approved construction documents. (IM 014 NACU6)

6.5 Protection from Decay. SIPs that rest on exterior foundation walls shall not be located within 8-in. of exposed earth. SIPs supported by concrete or masonry that is in direct contact with earth shall be protected from the concrete or masonry by a moisture barrier. ^(IM 014 ACU6)

6.6 Protection from Termites. In areas subject to damage from termites, panels shall be protected from termites using an approved method. Panels shall not be installed below grade or in contact with earth. (IM 014 ACU7, ACU22)

6.7 Heat-Producing Fixtures. Heat-producing fixtures shall not be installed in panels unless protected by a method approved by the code official or documented in test reports. This limitation shall not be interpreted to prohibit heat-producing elements with suitable protection. (IM 014 NACU9)

6.8 Plumbing Installation. Plumbing and waste lines may extend at right angles through the wall panels but are not permitted vertically within the core. Lines shall not interrupt splines or panel plates unless approved by a registered design professional.

6.9 Voids and Holes

6.9.1 **Voids in Core**. Voids may be provided in the panel core during fabrication at predetermined locations only. Voids shall be limited to a single 1 in. maximum hole running parallel

to the panel span. Voids shall be spaced a minimum of 4 ft. on center, measured perpendicular to the panel span. Two 1/2 in. diameter holes may be substituted for the single 1 in. hole provided they are maintained parallel and within 2 in. of each other. (IM 014 ACU11)

6.9.2 **Holes in Panels**. Holes may be placed in panels during fabrication at predetermined locations only. Holes shall be limited to 4 in. x 4 in. square. The minimum distance between holes shall not be less than 4 ft. on center measured perpendicular to the panel span and 24 in. on center measured parallel to the panel span. Not more than three holes shall be provided in a single line of holes parallel to the panel span. The holes may intersect voids permitted elsewhere in this report. ^(IM 014 ACU15)

6.10 Panel Cladding

6.10.1 **Roof Covering.** The roof covering, underlayment and flashing shall comply with the applicable codes. All roofing materials must be installed in accordance with the manufacturer's installation instructions. The use of roof coverings requiring the application of heat during installation shall be reviewed and approved by a registered design professional.

6.10.2 **Exterior Wall Covering.** Panels shall be covered on the exterior by a water-resistive barrier as required by the applicable code. The water-resistive barrier shall be attached with flashing in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer. (IM 014 ACU9) The exterior facing of the SIP wall shall be covered with weather protection as required by the adopted building code or other approved materials. (IM 014 ACU10)

6.11 Interior Wall Covering. The SIP panel foam plastic core shall be separated from the interior of the building by an approved thermal barrier of ½ in. gypsum wallboard or equivalent thermal barrier where required by 2015 IBC 2603.

7. CONDITIONS OF USE

7.1 Net Zero SIPS LLC Building Panels as described in this report comply with the codes listed in Section 2 above, subject to the following conditions:

7.2 Installation complies with this report and the approved construction documents.

7.3 This report applies only to the panel thicknesses specifically listed herein. (IM 014 ACU3)

7.4 In use panel heights/spans shall not exceed the values listed herein. Extrapolation beyond the values listed herein is not permitted. (IM 014 ACU2)

7.5 The panels are manufactured in the production facilities noted in this report. (IM 014 NACU8)

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8. EVIDENCE SUBMITTED

NTA, Inc. has examined the following evidence to evaluate this product:

8.1 Review of each plant's quality assurance manual and inspection of manufacturer's production facility in accordance with NTA IM 036.

8.2 Plant certification inspection of manufacturer's

production facilities, test procedures, frequency and quality control sampling methods, test equipment and equipment calibration procedures, test records, dates and causes of failures when applicable in accordance with NTA IM 036.

8.3 Qualification test data in accordance with NTA IM 014 Standard Evaluation Plan 01 (IM 014 SEP 01).

8.4 Periodic quality assurance audits of the production facility(ies).

8.5 Periodic verification testing in accordance with NTA, Inc. NTA IM 014.

Evaluation evidence and data are on file with NTA, Inc. NTA, Inc. is accredited by the International Accreditation Service (IAS) as follows:

- ISO 17020 Inspection Agency (AA-682)
- ISO 17025 Testing Laboratory (TL-259)
- ISO 17065 Product Certification Agency (PCA-102)

The scope of accreditation related to testing, inspection or product certification pertain only to the test methods and/or standard referenced therein. Design parameters and the application of building code requirements, such as special inspection, have not been reviewed by IAS and are not covered in the accreditation. Product evaluations are performed under the direct supervision of Professional Engineers licensed in all jurisdictions within the United States as required by the building code and state engineering board rules.

9. FINDINGS

All products referenced herein are manufactured under an in-plant Quality Assurance program to ensure that the production quality meets or exceeds the requirements of the codes noted herein and the criteria as established by NTA, Inc. Furthermore, product must comply with the conditions of this report.

This report is subject to annual review.

10. IDENTIFICATION

Each eligible product shall be permanently marked to provide the following information:

10.1 The NTA, Inc. Certification mark, shown below;

10.2NTA's Certification No. NER-1017;

10.3In-plant quality assurance stamp;

10.4Identifier for production facility;

10.5 Project or batch number.





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| Property | Strong-Axis Bending |
|--|---------------------|
| Allowable Tensile Stress, <i>Ft</i> (psi) | 495 |
| Allowable Compressive Stress, Fc (psi) | 619 |
| Elastic Modulus (Bending), <i>E</i> _b (psi) | 780051 |
| Shear Modulus, G (psi) | 426 |
| Allowable Core Shear Stress, Fv (psi) | 7.1 |
| Core Compressive Modulus, Ec (psi) | 721 |
| Reference Depth, h _o (in.) | 4.500 |
| Shear Depth Factor Exponent, m | 0.76 |

Table 1: Basic Properties^{1, 2}

¹ All properties are based on a minimum panel width of 24-in.

² Refer to Structural Insulated Panel (SIP) Engineering Design Guide (SIP-EDG01-19) for details on engineered design using basic panel properties.

Table 2: Section Properties

| Panel Thickness, <i>h</i> (in.) | Core Thickness, c (in.) | Dead Weight, <i>w_d</i> (psf) | Facing Area, <i>A</i> _f (in.²/ft) | Shear Area, <i>A_v</i> (in.²/ft) | Moment of Inertia, / (in.⁴/ft) | Section Modulus, S (in.³/ft) | Radius of Gyration, r (in.) | Centroid -to- Facing Dist., y _c (in.) |
|---------------------------------------|-------------------------------|---|---|---|---|---------------------------------------|--------------------------------------|--|
| 4.5 | 3.63 | 3.6 | 10.5 | 48.8 | 43.3 | 19.3 | 2.03 | 2.25 |
| 6.5 | 5.63 | 4.0 | 10.5 | 72.8 | 96.5 | 29.7 | 3.03 | 3.25 |

Table 3: Allowable Uniform Transverse Loads ^{1, 3}

| Panel | 4-1/2 in. Thick SIP | | | 6-1/2 in. Thick SIP | | | | |
|--------|---------------------|-------------------------------|-------|---------------------|-------------------------------|-------|--|--|
| Length | De | Deflection Limit ² | | | Deflection Limit ² | | | |
| (ft) | L/180 | L/240 | L/360 | L/180 | L/240 | L/360 | | |
| 8 | 73 | 54 | 36 | 118 | 93 | 62 | | |
| 10 | 48 | 36 | 24 | 85 | 64 | 43 | | |
| 12 | 33 | 25 | 17 | 61 | 46 | 30 | | |
| 14 | 23 | 18 | 12 | 45 | 33 | 22 | | |
| 16 | 17 | 13 | 9 | 33 | 25 | 17 | | |
| 18 | 13 | 10 | 6 | 25 | 19 | 13 | | |
| 20 | 10 | 7 | 5 | 20 | 15 | 10 | | |
| 22 | 8 | 6 | 4 | 16 | 12 | 8 | | |
| 24 | 6 | 5 | 3 | 13 | 9 | 6 | | |

¹Table values assume a simply supported panel with 1.5 in. of continuous bearing on facing at supports (Cv = 1.0) with solid wood plates at bearing locations. Values do not include the dead weight of the panel. For wall panel capacities (4-1/2 in. and 6-1/2 in. thickness panels only) utilizing a zero-bearing configuration (Figure 1), the allowable load shall be determined using Cv = 0.89.

²Deflection limit shall be selected by building designer based on the serviceability requirements of the structure and the requirements of adopted building code. Values are based on loads of short duration only and do not consider effects of creep. ³Permanent loads, such as dead load, shall not exceed 0.50 times the tabulated load.

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| | Panel | | 4-1/2 in. Thick SIP | | | | | |
|--------|--------|--|---------------------|-------------------|-------------------|-------------------|-------------------|--|
| Panel | Dead | Uniform Transverse Load (psf) 0 10 25 30 55 | | | | | | |
| Length | Weight | | | | | | | |
| (ft) | (plf) | | All | owable A | xial Load | (plf) | | |
| 8 | 29.2 | 3900 | 3440 ^G | 2980 ^E | 2850 ^E | 1390 ^C | 1060 ^C | |
| 10 | 36.5 | 3510 | 2900 ^G | 2170 ^D | 1780 ^C | | | |
| 12 | 43.7 | 3020 | 2400 ^F | 1130 ^C | 660 ^B | | | |
| 14 | 51.0 | 2510 | 1810 ^E | | | | | |
| 16 | 58.3 | 2100 | 1210 ^D | | | | | |
| 18 | 65.6 | 1770 | 710 ^C | | | | | |
| 20 | 72.9 | 1500 | | | | | | |

| Table 4: Allowable Combined Axial and Transverse Loads for 4-1/2-in. |
|--|
| Thickness SIPs ^{1, 2, 3, 4} |

¹Allowable axial tension loads shall not exceed the allowable compression loads above. Loads may be interpolated to determine the allowable load under transverse loads or spans bounded by those provided. Deflections due to transverse loads are limited to L/180. All values are for normal duration and may not be increased for other durations. For applications requiring eccentric loads or loads applied to the face of the panel, contact the manufacturer for design assistance.

²Permanent loads, such as dead load, shall not exceed 0.50 times the tabulated load. ³Axial loads shall be applied concentrically to the top of the panel through repetitive members spaced not more than 24 inches on center. Such members shall be fastened to a rim board or similar member to distribute the load along the top of the SIP.

⁴The ends of both facings must bear on the supporting foundation or structure to achieve the tabulated axial loads.

⁵ When noted with the following superscript notes, values exceed the specified deflection ratio: ^AL/120, ^BL/180, ^CL/240, ^DL/360, ^EL/480, ^FL/600, ^GL/720. When the value is presented as a double dash (--), the value either is beyond the scope of the evaluation or exceeds the L/120 deflection ratio.

| | | 6-1/2 in. Thick SIP | | | | | |
|--------|------------|-------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Panel | Panel Dead | Uniform Transverse Load (psf) | | | | | |
| Length | Weight | 0 10 25 30 55 | | | | | |
| (ft) | (plf) | | Allo | wable Ax | cial Load | (plf) | |
| 8 | 32.4 | 4380 | 4140 ^G | 3810 ^G | 3710 ^G | 3220 ^D | 3130 ^D |
| 10 | 40.5 | 4200 | 3850 ^G | 3380 ^F | 3230 ^E | 2560 ^C | 2430 ^C |
| 12 | 48.5 | 3980 | 3500 ^G | 2910 ^E | 2730 ^D | 1050 ^B | 570 ^B |
| 14 | 56.6 | 3720 | 3130 ^G | 2430 ^D | 2140 ^c | | |
| 16 | 64.7 | 3430 | 2750 ^G | 1600 ^C | 990 ^C | | |
| 18 | 72.8 | 3120 | 2390 ^E | 630F | | | |
| 20 | 80.9 | 2810 | 1990 ^D | | | | |

Table 5: Allowable Combined Axial and Transverse Loads for 6-1/2-in. Thickness SIPs^{1, 2, 3, 4}

See Table 4 for notes.

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| | · · · · · · · · · · · · · · · · · · · |
|------------------------|---|
| Span⁴ (ft) | 4-1/2 in. Thick SIPs 12 in. Depth Header ^{3,5} (plf) |
| 4.0 | 660 |
| 4.5 | 585 |
| 5.0 | 525 |
| 5.5 | 480 |
| 6.0 | 440 |
| 6.5 | 405 |
| 7.0 | 375 |
| 7.5 | 350 |
| 1) / artical landa anh | Lateral loads on booder and energing |

Table 5: Allowable Header Loads^{1,2} (Dead + Live)

¹Vertical loads only. Lateral loads on header and opening shall be resisted by engineered framing provided around opening. Jack/jamb studs shall be provided on each side of each opening to transfer loads into the supporting structure. ²Permanent loads, such as dead load, shall not exceed 0.50 times the tabulated value.

³Typical panel with single top and bottom plate installed at header location.

⁴For longer spans, engineered header members and support columns shall be built into the panel as determined by the designer of record.

⁵Allowable load is based on ultimate test load with a safety factor of 3 rounded down to the nearest 5 plf. Allowable load will produce a deflection less than L/360

| Table 6 | : Allowable In-Plane Shear Strength (Pounds per Foot) |
|-----------------------|--|
| for SIP Shear Walls (| Wind and Seismic Loads in Seismic Design Categories A, B and C) ^{1,3} |
| | |

| | Nominal Min. SIP | Mini | Shear | | |
|-------------------------------|---------------------|--|---|---|-------------------|
| Spline Type ³ | Thickness (in.) | Chord ² | Plate ² | Spline ³ | Strength (plf) |
| Block or Surface Spline | 4-1/2 | #2 SPF, 2x Lumber, KD-HT 0.113-in. x 2-in. Bright Basic Smooth Shank nail. 4-in. O.C. 3/4- in. Edge Distance | #2 SPF, 2x Lumber, KD- HT 0.113-in. x 2-in. Bright Basic Smooth Shank nail. 4-in. O.C. 3/4-in. Edge Distance | #2 SPF, 4x Lumber, KD-HT 0.113-in. x 2-in. Bright Basic Smooth Shank nail. 4-in. O.C. 3/4-in. Edge Distance | 326 |

¹Maximum shear wall dimension ratio 2:1 (height:width) for resisting wind or seismic loads. ²Chords, hold downs and connection to other structural elements must be designed by a registered design

professional in accordance with accepted engineering practice.

³Lumber Spline type is required at interior panel-to-panel joints and at each end of each shear wall segment. ⁴Required connections must be made on each side of the panel. Dimensional or engineered lumber shall have an equivalent specific gravity of 0.42 or greater.

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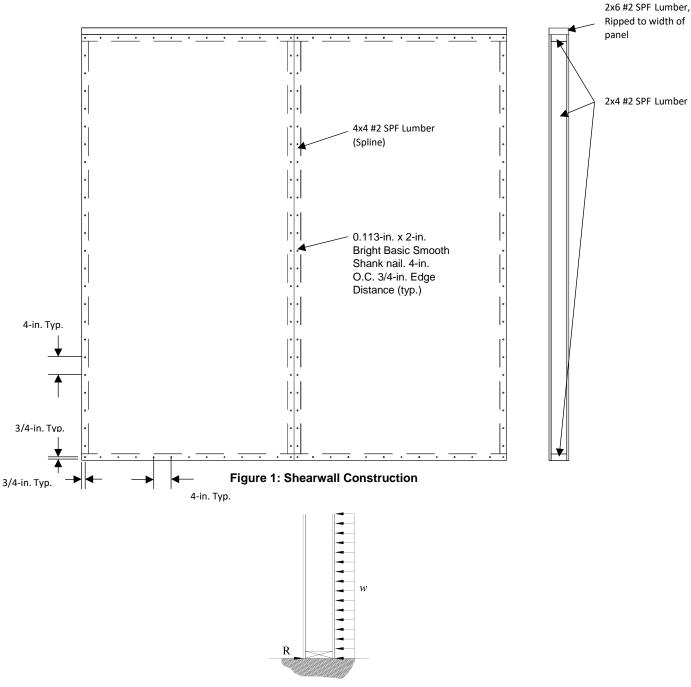


Figure 2: Zero Bearing Support

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Figure 3: Net Zero SIPS LLC, Structural Insulated Panels

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