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**Initial Approval**  
October, 2013

**Re-Approved**  
July, 2017

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**Report Owner**  
**United States Gypsum Company**  
700 North Highway 45  
Libertyville, IL 60048

**Approved Manufacturing Locations**  
**USG Structural Technologies, LLC**  
309 Hallberg Street  
Delavan, WI 53115

**Product**  
**USG Structural Panel Concrete Subfloor**  
(a.k.a. 3/4" STRUCTO-CRETE™ Structural Concrete Panels)

**For Evaluation Report Questions**  
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**General Details**

The approved manufacturing plant has an approved Q.C. Manual to manufacture USG Structural Panel Concrete Subfloor and is audited quarterly by Progressive Engineering Inc. USG Structural Panel Concrete Subfloor is also known as 3/4" STRUCTO-CRETE Structural Concrete Panels, and the contents of this **PER** are applicable to both product names.

**Product Description**

USG Structural Panel Concrete Subfloor is a noncombustible concrete sheathing panel used in conjunction with cold-formed steel, wood, or hot-rolled steel framing to form a load bearing structural floor or wall system. USG Structural Panel Concrete Subfloor is a nominal 3/4" [19mm] thick x 4' [1220mm] wide x 8' [2440mm] long. The floor panels have a Tongue and Groove edge along the 8' [2440mm] sides and the wall panels are square edged. The panels have a maximum weight of 5.3psf [25.9 kg/m<sup>2</sup>] from the manufacturing plant. The panels are a composite material consisting of alkali-resistant fiberglass and a cementitious binder.

USG Structural Panel Concrete Subfloor are noncombustible per ASTM E136 (CAN CSA S114) and have a mold resistance value of no less than 10 per ASTM D3273 and a rating of 1 or less per ASTM G21. These panel products have also been shown to be termite resistant when tested in accordance with AWPA Standard E1-13 exposure C, and comply with the VOC emission requirements of the California Department of Public Health CDPH/EHLB/Standard Method Version 1.1 (Emission testing method for CA Specification 01350).

**Product Application**

USG Structural Panel Concrete Subfloor is used as a single floor or as the subfloor (Concrete Subfloor) in conjunction with an underlayment to form a structural floor system to resist gravity loading, floor diaphragm loading and concentrated loading as typically found in Residential and Commercial Type I or Type II Construction. Product may also be used in wall applications in accordance with Table 8 and Table 9.

**Framing**

Cold-formed steel framing shall comply with AISI and have minimum yield strength of 50 ksi, minimum 18 ga. [40mil] or 0.0403" [1.0236mm] thickness, and minimum G60 galvanized coating. Member flanges must have a minimum width of 1-5/8" [41.27mm]. As an alternative, SPF lumber or 1/4" A36 steel framing may also be used in conjunction with the fasteners and edge distance listed in Table 2. Typical frame spacing ranges from 12" o.c. [304.8mm] to 24" o.c. [406.4mm] for floors. See Table 4 and Table 5 for floor diaphragm shear design values.

**Compliance**

|   |  |
|---|--|
| <p><b>2012 International Residential Code</b><br/>Section R301.1.3</p>                    | <p><b>2012 International Building Code</b><br/>Section 703.5.1<br/>Section 703.5.2<br/>Section 1607.4</p>              |
| <p><b>2015 International Residential Code</b><br/>Section R301.1.3<br/>Section R302.6</p> | <p><b>2015 International Building Code</b><br/>Section 703.5.1<br/>Section 703.5.2<br/>Section 1607.3 &amp; 1607.4</p> |

- Meets or exceeds the requirements of ICC-ES AC 318 Structural Cementitious Floor Sheathing Panels, Effective July 1, 2009.
- Meets or exceeds the requirements of ICC-ES AC 319 Horizontal Diaphragms Consisting of Structural Cementitious Floor Sheathing Panels Attached to Cold-formed Steel Framing—Approved June 2005, Editorially Revised January.

### Compliance Continued

- Meets the requirements of Table R301.7 Allowable Deflection of Structural Members for Joist Spacing of 24" [610mm] o.c. per the 2012 & 2015 IRC.
- Meets or exceeds the requirements for noncombustible core in accordance with Section 703.5.1 of the 2012 & 2015 IBC.
- Meets or exceeds the requirements for materials having a structural base of noncombustible material when tested in accordance with ASTM E 136 as defined in 2012 & 2015 IBC Section 703.5.2 and CAN CSA S114.
- Meets the requirements of Section R301.1.3 Engineered Design for otherwise conventional construction for buildings per the 2012 & 2015 IRC.
- For Canadian applications suitability needs to be reviewed by Architect or Engineer of record prior to use.
- Meets or Exceeds the requirements of the 2012 & 2015 IBC Table 1607.1 Minimum Uniformly Distributed Live Loads and Minimum Concentrated Live Loads, when installed per manufacturer's instructions.
- Surface Burning Characteristics - Flame Spread Index of 0 / Smoke Development Index of 0 or less when tested in accordance with ASTM E 84.
- Meets & exceeds requirements for concentrated load per ICC AC318 when tested in accordance with ASTM E661 using a 1" [25mm] and 3" [76mm] loading diameter for Wet & Dry conditions.
- USG Structural Panel Concrete Subfloor is allowed for occupancies or uses where concentrated load resistance, as required by Section 1607.1 of the IBC, is 1,000 pounds [4.45kN] or less. Actual concentrated load compliance shall be verified and approved by the engineer of record based upon the occupancy served and the expected end-use of the structure. For buildings with 2000 pound requirement over a 2.5ft by 2.5ft area, framing must be spaced a maximum of 12" o.c.

### General Product Installation

1. USG Structural Panel Concrete Subfloor is to be installed and maintained during construction following this report and the USG installation instructions. Installation instructions must be made easily available to the product installer.
2. When cutting USG Structural Panel Concrete Subfloor, safety glasses and a NIOSH approved N-95 dust mask should be worn at all times due to dust produced by the cutting of this product.
3. Fasteners shall be flush or slightly below the surface and care must be taken to not strip out in the framing. No fastener shall be installed within 2" [50.8mm] of the corner of a panel and shall not be closer than the minimum distance from panel edges indicated in Table 2 of this **PER**.
  1. The tongue and groove joints shall be oriented perpendicular to the framing.
  2. The 3/4" [19mm] USG Structural Panel Concrete Subfloor is fastened to the cold-formed steel, hot-rolled steel, or wood floor framing with the applicable fasteners indicated in Table 2 of this report.
  3. Install panels in a running board pattern bridging a minimum of 2 framing spans. The minimum panel width, measured parallel to the framing, shall be no less than 24" [690.6mm].
  4. Fasteners are applied as shown on the following Screw pattern A, B & C diagrams.
  5. Up to a 6" [152.4mm] x 6" cutout through the panels is allowed without blocking. Up to a 44" [1117.6mm] x 44" cutout is allowed with sufficient blocking around the perimeter of the opening. Larger openings shall be designed by the Engineer of record and are beyond the scope of this report.
  6. USG Structural Panel Concrete Subfloor must be protected from construction abrasive wear and impact after panel installation until the floor has its final finish applied. Refer to the USG Installation Instructions.

### Product Storage

USG Structural Panel Concrete Subfloor shall be stored in a dry location. Placement of the palletized product must be on level firm ground or a floor capable of carrying the approximate 3,400 lb [1545kg] pallet weight. Pallets shall not be stacked more than three high and must be stacked with direct alignment on the pallet below it. If a dry location is unavailable, cover pallets with a waterproof tarp or covering. Sub-freezing temperature may cause the panels to freeze together. Should this happen, move the panels to a warmer location to thaw out. Do not use tools or chemicals to loosen the panels as this will cause damage to the panels and will void the performance ratings described in this **PER**.

### Product Labeling

Each bundle shipped of **USG** Structural Panel Concrete Subfloor that are covered by this **PER**, must have a label attached with at least the following information:

1. **USG** Name and Location / Plant Number
2. Date of manufacture
3. This **PER** Number & *Pei* **ES** Logo

### Acceptable Evaluation Marks



**Table 1: Physical and Mechanical Properties**

USG Structural Panel Concrete Subfloor

|  | Test Standard | Values   |
|--|---------------|--|
| Concentrated Load  | ASTM E661     | 550 lb [2.45 kN] Static<br>0.108" [2.7 mm] max. deflection @ 200lb [0.89 kN] |
| Fastener Lateral Resistance <sup>1</sup>                                 | ASTM D1761    | Dry >210 lb [0.93 kN]<br>Wet >160 lb [0.71 kN]                               |
| Density - Oven Dried <sup>2</sup>  | ASTM C1185    | 75 lb/ft <sup>3</sup> [1200 kg/m <sup>3</sup> ]                              |
| Weight, 3/4" [19mm]<br>Thickness Delivered                               | ASTM D1037    | 5.3 lb/ft <sup>2</sup> [25.9 kg/m <sup>2</sup> ]                             |
| pH Value   | ASTM D1293    | 10.5   |
| Linear Variation with Change in Moisture<br>25% to 90% Relative Humidity | ASTM C1185    | <0.10%   |
| Thickness Swell  | ASTM D1037    | max. 3.0%  |
| Freeze/Thaw resistance   | ASTM C1185    | Passed 50 cycles   |
| Mold Resistance  | ASTM D3273    | 10   |
|  | ASTM G21      | 0  |
| Water Absorption <sup>3</sup>  | ASTM C1185    | <15.0%   |
| Noncombustibility  | ASTM E136     | Passed   |
| Surface burning Characteristics  | ASTM E84      | 0 Flame Spread / Smoke Developed Index 0                                     |
| Long Term Durability   | ASTM C1185    | min. 75% retention of physical properties                                    |
| Water Durability   | ASTM C1185    | min. 70% retention of physical properties                                    |
| Water Vapor Transmission (Method B)                                      | ASTM E96      | Permeance <2 Perm  |

1. Fastener Lateral Resistance measured with applicable fasteners in Table 2.

2. Density Measured at Equilibrium Conditioning per Section 5.2.3.1-Tested 28 days after manufacturing

3. Absorption Measured from Equilibrium Conditioning followed by immersion in Water for 48 hours

**Table 2: Acceptable Diaphragm Fasteners<sup>1</sup>**

USG Structural Panel Concrete Subfloor

| Framing Type                  | Minimum Edge Distance | Manufacturer                        | Part No.  | Type  |
|-------------------------------|-----------------------|-------------------------------------|-----------|---|
| 16ga Cold-Formed Steel        | 1/2" [13mm]           | Grabber Construction Products, Inc. | CGH8158LG | #8 x 1-5/8" winged self-drilling screw                        |
|                               |                       | Simpson Strong-Tie Company, Inc.    | CBSDQ158S | #8 x 1-5/8" winged self-drilling screw                        |
| 18ga Cold-Formed Steel        | 1" [26mm]             | Grabber Construction Products, Inc. | CGH8158LG | #8 x 1-5/8" winged self-drilling screw                        |
| SPF Lumber (Min. S.G. = 0.42) | 5/8" [16mm]           | Grabber Construction Products, Inc. | C8200L2M  | #8 x 2", Flat Head, Type 17, Nibs, GrabberGard,               |
|                               |                       | Simpson Strong-Tie Company, Inc.    | WSNTLG2S  | #8 x 2", Flat Head, Twin threads, Nibs                        |
|                               | 1/2" [13mm]           | Senco <sup>2</sup>                  | GL24AABF  | 8d Ring Shank Nails   |
| 1/4" A36 Hot Rolled Steel     | 3/4" [19mm]           | Simpson Strong-Tie Company, Inc.    | TBG1260S  | #12 x 2-3/8", Flat Head, Strong-Drive® TB WOOD-TO-STEEL Screw |

Note:

1. Fastener pull-through capacity of 581-lbs [2584N] may be applied to all listed fasteners. Capacity is based upon the minimum average **ultimate tested capacity** for all tabulated fasteners. The engineer or designer of record shall apply an appropriate safety factor (ASD) or resistance factor (LRFD).

2. Senco 8d ring shank nails are manufactured with a length of 2-3/8" [60mm], a head diameter of 0.266" [6.8mm], and a shank diameter of 0.113" [2.9mm]. Equivalent 8d ring shank nails meeting these dimensional requirements may be utilized when approved by the engineer or designer of record.

**Floor Usage**

**Table 3: Uniform Live Load Performance Rating<sup>2,4</sup>**

**USG** Structural Panel Concrete Subfloor

| Span Rating             | Conditions | Live Load Rating <sup>1</sup><br>(PSF) |
|-------------------------|------------|--|
| <b>12"</b><br>[304.8mm] | Dry or Wet | 430 <sup>3</sup><br>[63.2 kPa]         |
| <b>16"</b><br>[406.4mm] | Dry or Wet | 238 <sup>3</sup><br>[35.6 kPa]         |
| <b>24"</b><br>[609.6mm] | Dry or Wet | 100<br>[15.8 kPa]                      |

Notes

1. Live load ratings have been determined from testing based upon a minimum 100 psf service live load for the 24" span rating and a maximum panel live load deflection = L/360.
2. **Two framing spans minimum per panel piece**
3. Tabulated live load ratings are valid for a service level dead load of 10 psf or less.
3. Live load rating values for 12" and 16" span ratings are by engineering analysis based upon 24" span rating results and L/360 deflection criteria.

**Table 4 - Safety Factors and Resistance Factors for Diaphragms**

**USG** Structural Panel Concrete Subfloor

| Framing Type        | Fastener Type   | Earthquake        |                  |                              | Wind              |                  |                              |
|---------------------|-----------------|-------------------|------------------|------------------------------|-------------------|------------------|------------------------------|
|                     |                 | $\Omega$<br>(ASD) | $\phi$<br>(LRFD) | $\phi$<br>(LSD) <sup>4</sup> | $\Omega$<br>(ASD) | $\phi$<br>(LRFD) | $\phi$<br>(LSD) <sup>4</sup> |
| Steel <sup>1</sup>  | Screws          | 2.50              | 0.65             | 0.60                         | 2.35              | 0.70             | 0.65                         |
| Wood <sup>2,3</sup> | Screws or Nails | 3.30              | 0.50             | --                           | 2.35              | 0.70             | --                           |

Notes:

1. **Tabulated values have been evaluated for horizontal diaphragm use only.**
2. Safety factors and resistance factors for USG Structural Panel Concrete Subfloor diaphragms installed over cold-formed and hot-rolled steel framing are based upon Table D5 of AISI S100-2007.
3. Safety factors and resistance factors for USG Structural Panel Concrete Subfloor diaphragms installed over wood studs are based on the worst case of the standard factors from the American Wood Council Special Design Provisions for Wind and Seismic (AWC SDPWS-2008) and those tabulated for steel framing.
4. Earthquake factors for installations over wood construction are based upon the wind factors modified by a factor of 1.4 to match the general seismic strength reduction observed in Tables 4.2A, 4.2B, 4.2C, and 4.2D of AWC SDPWS-2008.
5. Limit States Design (LSD) shall be used in combination with the load combinations found in the National Building Code of Canada (NBCC).

**Table 5: Simple Beam Diaphragm Testing**  
**USG Structural Panel Concrete Subfloor**

| Fastener Spacing |                  | Joist           |                  | Screw Pattern | Panel Blocking                               | S <sub>n</sub> - Nominal Shear Strength (plf) | X     | Aspect Ratio |
|------------------|------------------|-----------------|------------------|---------------|--|---|-------|--------------|
| Perimeter        | Field            | Gauge *         | Spacing          |               |  |   |       |              |
| 4"<br>[101.6mm]  | 12"<br>[304.8mm] | 16<br>[1.438mm] | 16"<br>[406.4mm] | B             | None   | 1462<br>[21.3 kN/m]                           | 0.443 | 3:1          |
| 6"<br>[152.4mm]  |                  |                 |                  |               |  | 1395<br>[20.4 kN.m]                           |       |              |
| 4"<br>[101.6mm]  | 12"<br>[304.8mm] | 16<br>[1.438mm] | 24"<br>[609.6mm] | B             | None   | 1341<br>[19.6 kNm]                            | 0.476 | 3:1          |
| 6"<br>[152.4mm]  |                  |                 |                  |               |  | 1053<br>[15.4 kNm]                            |       |              |
| 6"<br>[152.4mm]  | 12"<br>[304.8mm] | 16<br>[1.438mm] | 24"<br>[609.6mm] | C             | 4" [101.6mm] wide x<br>16ga. [1.438mm] Strap | 1468<br>[21.4 kNm]                            | 0.180 | 4:1          |

Refer to Table 4 of this PER for applicable diaphragm safety ( $\Omega$ ) and load resistance ( $\phi$ ) factors corresponding to ASD, LRFD, and/or LSD design methods.

**Screw Pattern B**- Panel fasteners must be inset 2" [51mm] from the corners. Fastener edge distance at all panel edges must comply with Table 2 distances with exception to the tongue and groove joints where the framing joists are perpendicular to the joint. The fasteners should be kept flush or slightly below the surface of the panel. At the T&G panel joists where the framing joists are perpendicular to the joint, one (1) panel fastener is required. One fastener should be 1" [25mm] and the other 2" [51mm] from the panel edge.

**Screw Pattern C** - Panels shall be fastened as described in Screw Pattern B with the addition of fasteners at 6" [152mm] o.c. along the metal Strap Blocking on both sides of seam .

\* The values shown apply to 18 ga. Framing using the minimum of 1" edge distance as shown in Table 2.

### Deflection Equation for Simple Beam Diaphragm

$$\Delta = \frac{5Vl^3}{8EAb} + \frac{Vl}{4Gt} + Xle_n$$

Where: V = Unit shear in the direction under consideration, plf

ℓ = Diaphragm length, ft.

b = Diaphragm width, ft.

E = Elastic modulus of steel rim chords, 29,500,000psi

A = Net area of steel rim chord cross section, in<sup>2</sup>

G = Shear modulus of USG Structural Panel Concrete Subfloor for shear, 285,714 psi

t = Effective thickness of USG Structural Panel Concrete Subfloor for shear, 0.73 in.

e<sub>n</sub> = Screw joint slippage at load per screw on perimeter of interior panel

$$e_n @ 0.20S_u = 0.011$$

$$e_n @ 0.33S_u = 0.019$$

$$e_n @ 0.60S_u = 0.032$$

$$e_n @ S_u = 0.084$$

X = Slip Co-efficient. See Table 3 above.

**Table 6: Cantilever Floor Diaphragm Testing**  
**USG Structural Panel Concrete Subfloor**

| Fastener Spacing |                  | Joist Spacing    | Screw Pattern | Panel Blocking                             | S <sub>n</sub> - Nominal Shear Strength (plf)* | X     |
|------------------|------------------|------------------|---------------|--|--|-------|
| Perimeter        | Field            |                  |               |  |  |       |
| 6"<br>[152.4mm]  | 12"<br>[304.8mm] | 24"<br>[609.6mm] | B             | None                                       | 487<br>[7.1 kN/m]                              | 0.518 |
| 8"<br>[203.2mm]  | 12" [304.8mm]    | 24"<br>[609.6mm] | B             | None                                       | 475<br>[6.9 kN/m]                              | 0.511 |
| 4"<br>[101.6mm]  | 12" [304.8mm]    | 24"<br>[609.6mm] | A             | None                                       | 713<br>[10.4 kN/m]                             | 0.732 |
| 6"<br>[152.4mm]  | 12"<br>[304.8mm] |                  |               |  | 525<br>[7.7 kN/m]                              | 0.625 |
| 8"<br>[203.2mm]  | 12"<br>[304.8mm] |                  |               |  | 465<br>[6.8 kN/m]                              | 0.754 |
| 4"<br>[101.6mm]  | 12"<br>[304.8mm] | 16"<br>[406.4mm] | A             | None                                       | 975<br>[14.2 kN/m]                             | 0.833 |
| 6"<br>[152.4mm]  | 12"<br>[304.8mm] |                  |               |  | 915<br>[13.4 kN/m]                             | 0.765 |
| 8"<br>[203.2mm]  | 12"<br>[304.8mm] |                  |               |  | 860<br>[12.6 kN/m]                             | 0.702 |
| 4"<br>[101.6mm]  | 12"<br>[304.8mm] | 12"<br>[304.8mm] | A             | None                                       | 1121<br>[16.4 kN/m]                            | 0.759 |
| 6"<br>[152.4mm]  | 12"<br>[304.8mm] |                  |               |  | 940<br>[13.7 kN/m]                             | 0.541 |
| 8"<br>[203.2mm]  | 12"<br>[304.8mm] |                  |               |  | 772<br>[11.3 kN/m]                             | 0.484 |
| 6"<br>[152.4mm]  | 12"<br>[304.8mm] | 24"<br>[609.6mm] | C             | 4" [101.6mm]wide x<br>16ga.[1.438mm] Strap | 1148<br>[19.8 kN/m]                            | 0.354 |

Refer to Table 4 of this PER for applicable diaphragm safety (Ω) and load resistance (ϕ) factors corresponding to ASD, LRFD, and/or LSD design methods.

2 to 1 maximum Aspect Ratio

**Screw Pattern A & B**- Panel fasteners must be inset 2" [51mm] from the corners. Fastener edge distance at all panel edges must comply with Table 2 distances with exception to the tongue and groove joints where the framing joists are perpendicular to the joint. The fasteners should be kept flush or slightly below the surface of the panel. At the T&G panel joists where the framing joists are perpendicular to the joint, two (2) panel fasteners are required for Pattern A and one (1) fastener for Pattern B. One fastener should be 1" [25mm] and the other 2" [51mm] from the panel edge.

**Screw Pattern C** - Panels shall be fastened as described in Screw Pattern B with the addition of fasteners at 6" [152mm] o.c. along the metal Strap Blocking on both sides of seam .

### Deflection Equation for Cantilever Diaphragm

$$\Delta = \frac{5V(2l)^3}{8EAb} + \frac{V(2l)}{4Gt} + X(2l)e_n$$

Where: V = Unit shear in the direction under consideration, plf

ℓ = Diaphragm length, ft.

b = Diaphragm width, ft.

E = Elastic modulus of steel rim chords, 29,500,000psi

A = Net area of steel rim chord cross section, in<sup>2</sup>

G = Shear modulus of USG Structural Panel Concrete Subfloor for shear, 285,714 psi

t = Effective thickness of USG Structural Panel Concrete Subfloor for shear, 0.73 in.

e<sub>n</sub> = Screw joint slippage at load per screw on perimeter of interior panel

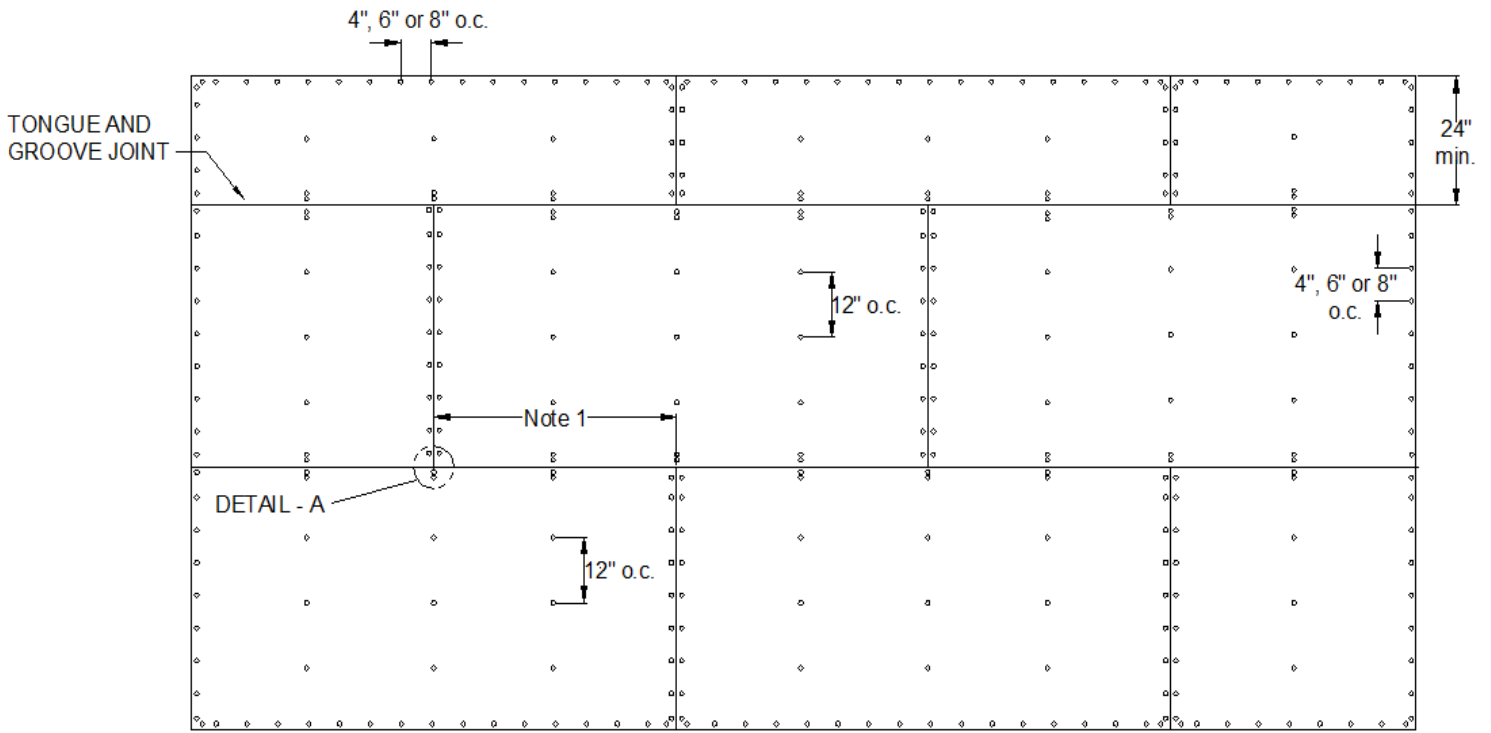
$$e_n @ 0.20S_u = 0.011$$

$$e_n @ 0.33S_u = 0.019$$

$$e_n @ 0.60S_u = 0.032$$

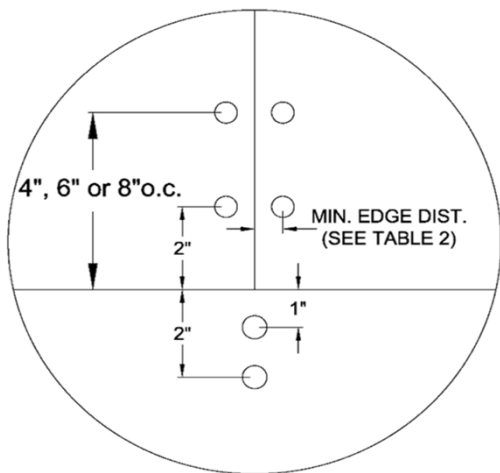
$$e_n @ S_u = 0.084$$

X = Slip Co-efficient. See Table 4 above.

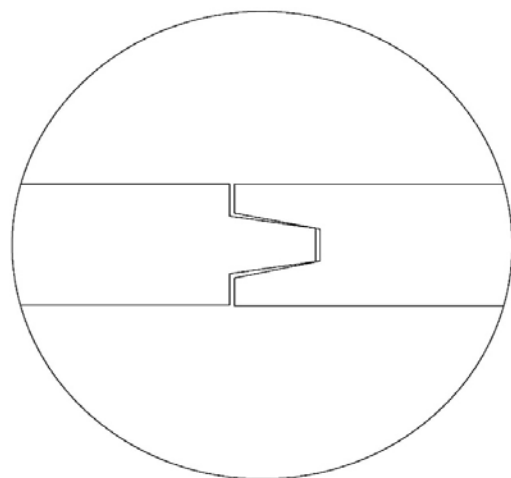


1. Two Span offset of Seams w/o Blocking, One Span w/ Blocking.

## Screw Pattern A

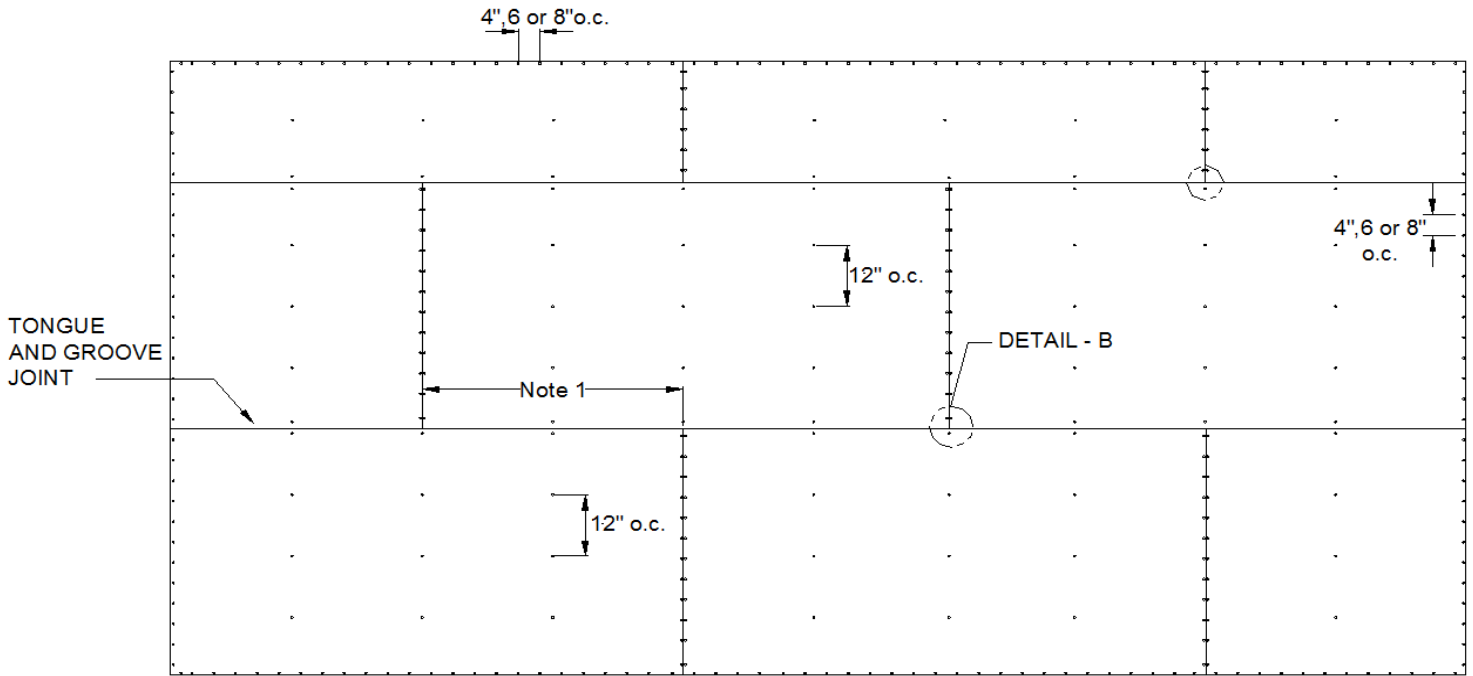


DETAIL - A



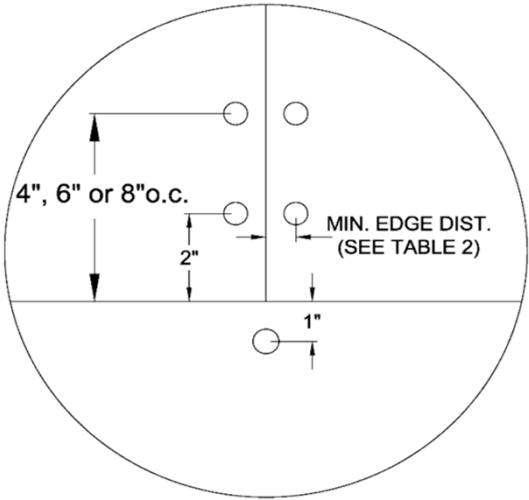
Tongue & Groove

**Figure 1 - Screw Pattern "A" Details**

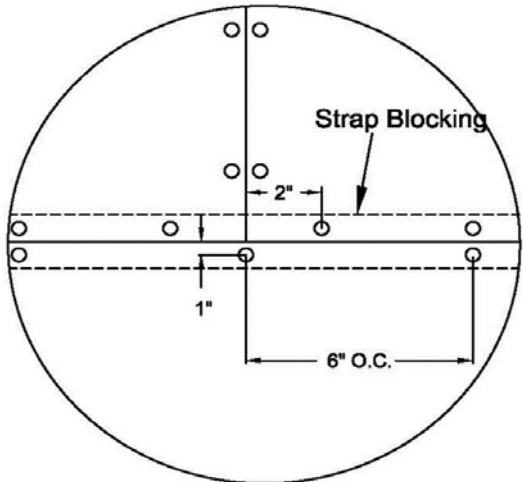


1. Two Span Minimum offset of Seams w/o Blocking, One Span offset w/ Blocking.

**Screw Pattern B**



**DETAIL - B**



**Strap Block Detail for Screw Pattern C**

**Figure 2 - Screw Pattern "B" & "C" Details**



**Table 7: Floor Anchorage Options - USG Structural Panel Concrete Subfloor<sup>1,2,3</sup>**

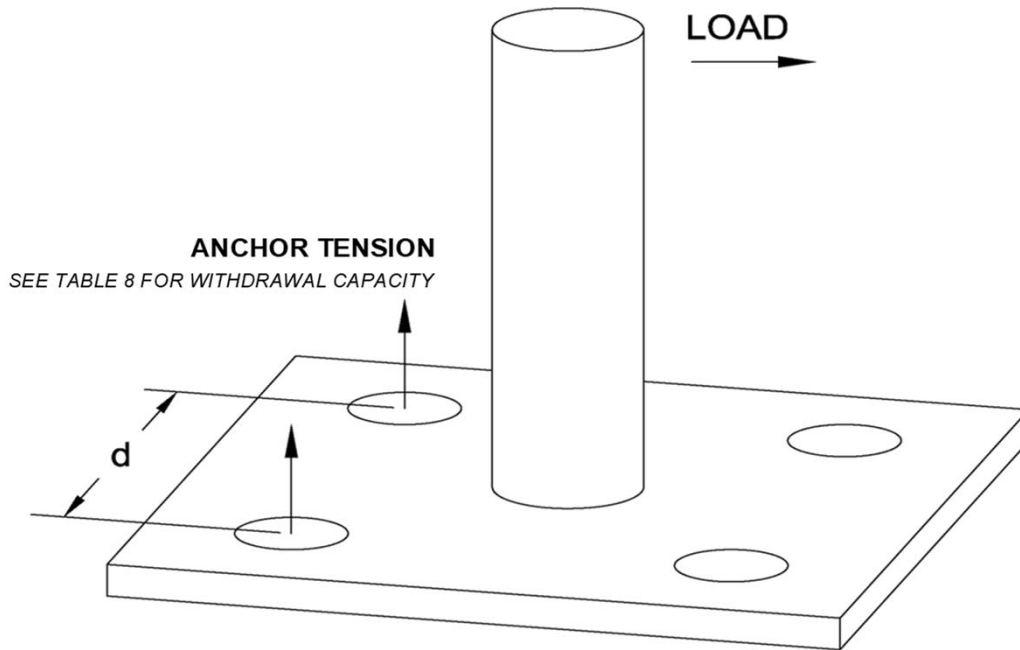
Nominal Withdrawal Capacities per Anchor

| Anchor Type                     | ASTM D 1037 Value (1 Layer) | Subfloor Layers | Distance Between Bolts, d |          |          |          |         |         |         |         |
|---------------------------------|-----------------------------|-----------------|---------------------------|----------|----------|----------|---------|---------|---------|---------|
|                                 |                             |                 | 2"                        | 4"       | 6"       | 8"       | 51mm    | 102mm   | 152mm   | 203mm   |
| 3/8" SnapToggle® <sup>4</sup>   | 1481 lb [6588 N]            | 1               | 927 lb                    | 1072 lb  | 1154 lb  | 1166 lb  | 4124 N  | 4768 N  | 5133 N  | 5187 N  |
|                                 |                             | 2               | 1719 lb*                  | 1719 lb* | 1719 lb* | 1719 lb* | 7646 N* | 7646 N* | 7646 N* | 7646 N* |
| 1/2" SnapToggle® <sup>5</sup>   | 1616 lb [7188 N]            | 1               | 948 lb                    | 1085 lb  | 1166 lb  | 1176 lb  | 4217 N  | 4826 N  | 5187 N  | 5231 N  |
|                                 |                             | 2               | 1843 lb                   | 2088 lb  | 2273 lb  | 2400 lb  | 8198 N  | 9287 N  | 10111 N | 10676 N |
| 1/4"x3" Peel Rivet <sup>6</sup> | 758 lb [3372 N]             | 1               | 636 lb                    | 668 lb   | 668 lb   | 668 lb   | 2829 N  | 2971 N  | 2971 N  | 2971 N  |

*For ASD designs use minimum  $\Omega = 4.0$ ; For LRFD designs use maximum  $\phi = 0.40$*

Notes:

1. TOGGLER Anchor System and peel rivet capacity is based on random anchors purchased from a distributor and have not been evaluated for installations other than that described in Table 8 and Figure 3. This **PER** verifies the USG Structural Panel Concrete Subfloor capacity only, and actual toggler anchor capacity without panel failure shall be verified by the engineer or designer of record through the SnapToggle anchor or peel rivet manufacturer.
  2. TOGGLER Anchor System shall be installed with a maximum torque setting of 200 in-lb [23 N-m].
  3. Anchors have been evaluated for use general component connections to the USG Structural Panel Concrete Subfloor (i.e. auditorium seating, lightweight equipment, etc.). Final application must be reviewed and approved by the engineer or designer of record.
  4. TOGGLER Anchor System 3/8" SnapToggle® (Item No. BC) w/ a Grade 8 Hex Head Bolt. Ultimate withdrawal occurred at a maximum tested shear per pair of 232 lb [1032 N] for one-layer and 430 lb [1913 N] for two layers.
  5. TOGGLER Anchor System 1/2" SnapToggle® (Item No. BD) w/ a Grade 5 Hex Head Bolt. Ultimate withdrawal occurred at a maximum tested shear per pair of 294 lb [1308 N] for one-layer and 600 lb [2669 N] for two layers.
  6. Peel Rivets manufactured by SFS Intec (Part No. TPR-L-6, 3x76). Ultimate withdrawal occurred at a maximum tested shear per pair of 167 lb [743 N] for a single layer of USG Structural Panel Concrete Subfloor.
- \* Denotes Toggler Failure by Strip out.



**Figure 3 - Typical Toggler Bolt Application**

## Wall Usage

### Table 8

Tested Static Wall Shear Values using 16ga. [54mil] or 0.0538" [1.366mm] X 3-5/8" [92mm] flange Steel Studs **16"** [406mm] o.c.

| Sides Sheathed | Strap at Seam | Sheathing Orientation | Fastener Spacing |                | Ultimate Load in plf | G' Lbs./in | Ultimate Load kN/m | G' N/mm |
|----------------|---------------|-----------------------|------------------|----------------|----------------------|------------|--------------------|---------|
|                |               |                       | Perimeter        | Field          |                      |            |                    |         |
| Single         | no            | Vertical              | 8"<br>[203mm]    | 12"<br>[305mm] | 914                  | 6185       | 13.3               | 1083    |
| Single         | no            | Vertical              | 6"<br>[152mm]    | 12"<br>[305mm] | 1320                 | 7416       | 19.2               | 1299    |
| Single         | no            | Vertical              | 4"<br>[102mm]    | 12"<br>[305mm] | 1726                 | 8647       | 25.1               | 1514    |
| Single         | yes           | Horizontal            | 8"<br>[203mm]    | 12"<br>[305mm] | 984                  | 5535       | 14.3               | 969     |
| Single         | yes           | Horizontal            | 6"<br>[152mm]    | 12"<br>[305mm] | 1402                 | 7269       | 20.4               | 1273    |
| Single         | yes           | Horizontal            | 4"<br>[102mm]    | 12"<br>[305mm] | 1821                 | 9003       | 26.5               | 1577    |
| Double         | yes           | Horizontal            | 8"<br>[203mm]    | 12"<br>[305mm] | 1901                 | 13287      | 27.7               | 2327    |
| Double         | yes           | Horizontal            | 6"<br>[152mm]    | 12"<br>[305mm] | 2625                 | 22677      | 38.2               | 3971    |
| Double         | yes           | Horizontal            | 4"<br>[102mm]    | 12"<br>[305mm] | 3349                 | 32067      | 48.8               | 5616    |

*The Ultimate Load does not include a safety factor and walls have not been evaluated for cyclic design loads.*

### Table 9

Tested Static Wall Shear Values using 16ga. [54mil] or 0.0538" [1.366mm] X 3-5/8" [92mm] flange Steel Studs **24"** [610mm] o.c.

| Sides Sheathed | Strap at Seam | Sheathing Orientation | Fastener Spacing |                | Ultimate Load in plf | G' Lbs./in | Ultimate Load kN/m | G' N/mm |
|----------------|---------------|-----------------------|------------------|----------------|----------------------|------------|--------------------|---------|
|                |               |                       | Perimeter        | Field          |                      |            |                    |         |
| Single         | no            | Vertical              | 8"<br>[203mm]    | 12"<br>[305mm] | 819                  | 5882       | 11.9               | 1030    |
| Single         | no            | Vertical              | 6"<br>[152mm]    | 12"<br>[305mm] | 1201                 | 7736       | 17.5               | 1355    |
| Single         | no            | Vertical              | 4"<br>[102mm]    | 12"<br>[305mm] | 1584                 | 9590       | 23.1               | 1679    |
| Single         | yes           | Horizontal            | 8"<br>[203mm]    | 12"<br>[305mm] | 906                  | 5117       | 13.2               | 896     |
| Single         | yes           | Horizontal            | 6"<br>[152mm]    | 12"<br>[305mm] | 1292                 | 7384       | 18.8               | 1293    |
| Single         | yes           | Horizontal            | 4"<br>[102mm]    | 12"<br>[305mm] | 1679                 | 9590       | 24.5               | 1679    |
| Double         | yes           | Horizontal            | 8"<br>[203mm]    | 12"<br>[305mm] | 1730                 | 11684      | 25.2               | 2046    |
| Double         | yes           | Horizontal            | 6"<br>[152mm]    | 12"<br>[305mm] | 2432                 | 19945      | 35.4               | 3493    |
| Double         | yes           | Horizontal            | 4"<br>[102mm]    | 12"<br>[305mm] | 3135                 | 28207      | 45.7               | 4940    |

*The Ultimate Load does not include a safety factor and walls have not been evaluated for cyclic design loads.*