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**Initial Approval**  
November, 2014

**Re-Approved**  
July, 2020

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**Report Owner**

**United States Gypsum Company**

700 North Highway 45  
Libertyville, IL 60048

**Product**

**USG Structural Panel Concrete Roof Deck**

(a.k.a. 3/4" **USG Securock® Concrete Roof Deck Panel**)

**Approved Manufacturing Locations**

**USG Structural Technologies, LLC**

309 Hallberg Street  
Delavan, WI 53115

**For Evaluation Report Questions**

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**General Details**

The approved manufacturing plant has an approved Quality Control Manual to manufacture **USG Structural Panel Concrete Roof Deck** and is audited quarterly by **Progressive Engineering Inc.** **USG Structural Panel Concrete Roof Deck** is also known as 3/4" **USG Securock® Concrete Roof Deck Panels**, and the contents of this **PER** are applicable to both product names.

**Product Description**

**USG Structural Panel Concrete Roof Deck** 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 roof system. **USG Structural Panel Concrete Roof Deck** is a nominal 3/4" [19mm] thick x 4' [1220mm] wide x 8' [2440mm] long. Roof deck panels have either a Tongue and Groove edge along the 8' [2440mm] sides or square edge. Panels are manufactured from a composite material consisting of alkali-resistant fiberglass and a cementitious binder, which create a maximum panel weight of 5.3psf [25.9 kg/m<sup>2</sup>] from the manufacturing plant.

**USG Structural Panel Concrete Roof Deck** 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 AWWA 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

**Product Application**

**USG Structural Panel Concrete Roof Deck** is used as a roof deck sheathing to form a structural roof system to resist lateral and gravity loading, roof deck loading and concentrated loading as typically found in Residential and Commercial Type I or Type II Construction.

**Roof Framing**

Roof framing must be Cold-formed 50 ksi [345 MPa] steel framing complying with AISI and a minimum thickness of 18 ga. [40mil] or 0.0403" [1.0236mm] with a minimum G60 galvanized coating. Joist flanges supporting the **USG Structural Panel Concrete Roof Deck** must have a minimum width of 1-5/8" [41.27mm]. Roof frame spacing shall be no greater than 48" o.c. [1219mm]. As an alternative, SPF lumber, 1/8" [3mm] or 1/4" [6mm] steel framing may also be used in conjunction with the fasteners and edge distance listed in Table 2.

**Compliance**

International Residential Code	International Building Code	City of Los Angeles Building Code (LABC)	California Building Code
2012 - Section R301.1.3	2012 - Section 703.5.1	2017 Chapters 16 & 17 (As applicable)	2019 Section 703.5.1
2015 - Section R301.1.3 Section R302.6	Section 703.5.2 Section 1607.4		Section 703.5.2 Section 1607.3
2018 - Section R301.1.3	2015 - Section 703.5.1 Section 703.5.2 Section 1607.4	City of Los Angeles Residential Code (LARC)	Section 1607.4
	2018 - Section 703.5.1 Section 703.5.2 Section 1607.3 Section 1607.4	2017 Section R301.1.3	California Residential Code 2019 Section R301.1.3

- Meets or exceeds the requirements for FM Approval Standard 4474 (Class 1) in accordance with test standard TAS 114 with a wind uplift rating of 135 psf when using Duro-last PVC membrane that is fully adhered.
- Meets or exceeds the requirements of ICC-ES AC 318 Structural Cementitious Floor & Roof 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 2012.
- Meets the requirements of Table R301.7 "Allowable Deflection of Structural Members" for Joist Spacing of 48" o.c. [1219mm] using L/240 per the 2012 & 2015 IRC.
- Meets or exceeds the requirements for noncombustible core in accordance with Section 703.5.1 of the 2012, 2015 & 2018 IBC.

### Compliance Continued

- 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 & 2018 IBC, 2019 California Building Code Section 703.5.2. and CAN CSA S114.
- Meets or exceeds the nail withdrawal requirements of Table 6 of APA PS-2 for use as a roof sheathing.
- For Canadian applications suitability needs to be reviewed by Architect or Engineer of record prior to use.
- Meets the requirements of Section R301.1.3 Engineered Design for otherwise conventional construction for buildings per the 2012, 2015 & 2018 IBC and the 2019 California Residential Code.
- Surface Burning Characteristics - Flame Spread Index of 0 / Smoke Development Index of 0 when tested in accordance with ASTM E84.
- 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.
- Meets or exceeds the 2017 City of Los Angeles Building Code (LABC) - The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 & 17, as applicable.
- Meets or exceeds the requirements of the 2017 Los Angeles Residential Code (LARC) - Under the LARC, an engineered design in accordance with LARC Section R301.1.3 must be submitted.

### General Product Installation

1. **USG** Structural Panel Concrete Roof Deck 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. **USG** Structural Panel Concrete Roof Deck must be allowed to acclimate to job site conditions for a minimum of 48 hours.
3. When cutting **USG** Structural Panel Concrete Roof Deck, 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.
4. 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" [51mm] 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**. Fasteners must meet or exceed 1000-hour corrosion testing in accordance with ASTM B117.
5. For the attachment of shingles, **USG** recommends the use of electro-galvanized collated roofing nails installed by a professional grade pneumatic nailer with an air supply between 100 to 120 psi.

### Product Installation for Roof Applications

1. The tongue and groove joints shall be oriented perpendicular to the framing.
2. The 3/4" [19mm] **USG** Structural Panel Concrete Roof Deck is fastened to the cold-formed steel, hot rolled steel, or wood framing with the applicable fasteners indicated in Table 2.
3. Install panels in a running bond pattern so that the end joints fall over the center of the framing members and are staggered by at least two (2) supports where the end joints fall in the adjacent rows. Tongue and groove joints should be free of debris and fitted tightly without any gapping. For all panels less than 24 in. (610mm) wide, all edges must be supported by blocking. Blocking must be coldformed from steel complying with AISI General, with a minimum 54 mils (0.0538 inch or 1.36mm) base metal thickness (no. 16 gauge) and a minimum G60 galvanized coating. The attachment flange or bearing edge must be at least 1-5/8 in. (41mm) wide and at least 3/4 in. (19mm) of the panel must bear on the supporting flange or edge.
4. Fasteners are applied as shown in the Screw Pattern A, B, C, D, E or F diagrams, on pages seven (7) and eight (8) of this report.
5. Up to a 6" [152mm] x 6" cutout through the panels is allowed without blocking. Up to a 44" [1118mm] x 44" [1118mm] 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 Roof Deck shall not be left in service without an appropriate roof, or weather-resistive membrane covering.

### Product Storage

**USG** Structural Panel Concrete Roof Deck 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 lbs. [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**. High Traffic areas must be protected, consider supporting the T&G in corridors. If the T&G is damaged, this will need to be repaired.

### Product Labeling

Each bundle shipped of **USG** Structural Panel Concrete Roof Deck that is 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 Roof Deck**

	Test Standard	Requirements	Tested Values
Concentrated Load, Wet or Dry	ASTM E661	550 lb [2.45 kN] Static 0.108" [2.7 mm] max. deflection @ 200lb [0.89 kN]	804 lb [3.58 kN] Static 0.066" [1.7 mm] max. deflection @ 200lb [0.89 kN]
Fastener Lateral Resistance <sup>1</sup>	ASTM D1761	Dry >210 lb [0.93 kN] Wet >160 lb [0.71 kN]	Dry: 776 lb [3.45 kN] Wet: 800 lb [3.56 kN]
Density - Oven Dried <sup>2</sup>	ASTM C1185	minimum 75 lb/ft <sup>3</sup> [1200 kg/m <sup>3</sup> ]	78.6 lb/ft <sup>3</sup> [1258 kg/m <sup>3</sup> ]
Weight, 3/4" [19mm] Thickness as 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 25% to 90% Relative Humidity	ASTM C1185	<0.10%	0.06%
Thickness Swell	ASTM D1037	≤ 3.0%	0.04%
Freeze/Thaw resistance	ASTM C1185	Minimum of 75% retention of Physical Properties	100% Retention
Mold Resistance	ASTM D3273	10	10
	ASTM G21	≤ 1	≤ 1
Water Absorption <sup>3</sup>	ASTM C1185	<15.0%	9%
Noncombustibility	ASTM E136	Must Pass	Passed
Surface burning Characteristics	ASTM E84	0 Flame Spread / Smoke Developed Index 5	0 Flame Spread / Smoke Developed Index 0
Long Term Durability	ASTM C1185	min. 75% retention of physical properties	100%
Water Durability	ASTM C1185	min. 70% retention of physical properties	83%
Water Vapor Transmission (Method B)	ASTM E96		Permeance 1.4 Perm

**Notes:**

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**

Minimum Framing	Minimum Edge Distance	Manufacturer	Part No.	Type
16ga [1.438mm] Cold-Formed Steel	1/2" [13mm]	Grabber Construction Products, Inc.	CGH8158LG	#8 x 1-5/8" winged self-drilling screw
		Grabber Construction Products, Inc.	CGHM8200LG	#8 x 2" self-drilling screw
		Simpson Strong-Tie Company, Inc.	CBSDQ158S	#8 x 1-5/8" winged self-drilling screw
18ga [1.0236mm] Cold-Formed Steel	1" [25mm]	Grabber Construction Products, Inc.	CGH8158LG	#8 x 1-5/8" winged self-drilling screw
1/8" Hot Rolled Steel min. 50 ksi	1" [25mm]	Aerosmith	5324HPG	.145" dia. x 1-1/4" lg. power actuated fastener
		Hilti	X-U 32MX	.157" dia. x 1-1/4" lg. power actuated fastener
		Grabber Construction Products, Inc.	CC12250LRG	#12 x 2-1/2" winged self-drilling screw
		DeWalt	50458-PWR	.157" dia. x 1-1/4" lg. power actuated fastener
1/4" A36 Hot Rolled Steel	3/4" [19mm]	Grabber Construction Products, Inc.	CC12250LRG	#12 x 2-1/2" winged self-drilling screw
		Muro North America	RSM645	M6 x 45mm winged self-drilling screw
		Simpson Strong-Tie Company, Inc.	TBG1260S	#12 x 2-3/8", Flat Head, Strong-Drive® TB WOOD-TO-STEEL 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

**Notes:**

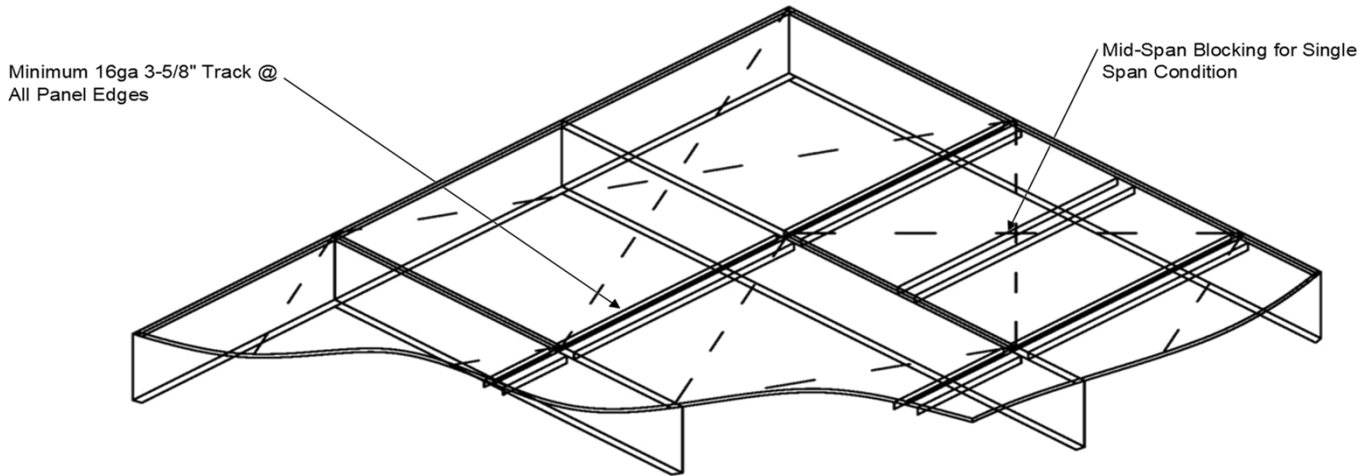
1. Fastener pull-through capacity of 581-lbs [2584N] may be applied to all listed fasteners. Capacity is based on **ultimate tested value** for all tabulated fasteners. The engineer or designer of record shall apply an appropriate safety factor (ASD) or resistance factor (LRFD).
2. Senco 8d ring shank 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.
3. Any length of the same fastener is approved provided a minimum of three (3) threads penetrate the steel framing.

**Table 3: Uniform Load Performance**  
**USG Structural Panel Concrete Roof Deck**

Span Rating <sup>1</sup>	Conditions	Live Load Rating <sup>2,3</sup> (PSF)	Nominal Uplift Capacity <sup>4</sup> (PSF)			
			8/12	8/8	6/6	4/4
<b>12"</b> [305mm]	Dry or Wet	1320 [63.2 kPa]	513 [24.6 kPa]	770 [36.9 kPa]	1026 [49.1 kPa]	1320 [63.2 kPa]
<b>16"</b> [406mm]	Dry or Wet	744 [35.6 kPa]	385 [18.4 kPa]	577 [27.6 kPa]	744 [35.6 kPa]	744 [35.6 kPa]
<b>24"</b> [610mm]	Dry or Wet	516 [24.7 kPa]	257 [12.3 kPa]	330 [15.8 kPa]	330 [15.8 kPa]	330 [15.8 kPa]
<b>32" *</b> [813mm]	Dry or Wet	<b>240</b> [11.5 kPa]	192 [9.2 kPa]	240 [11.5 kPa]	240 [11.5 kPa]	240 [11.5 kPa]
<b>48" *</b> [1219mm]	Dry or Wet	150 [7.2 kPa]	128 [6.1 kPa]	150 [7.2 kPa]	150 [7.2 kPa]	150 [7.2 kPa]

**Notes:**

- Two framing spans minimum per panel piece for span ratings of 12" [305mm] through 24" [813mm].
  - For ASD designs use minimum  $\Omega = 3.0$ ; For LRFD designs use maximum  $\phi = 0.50$ ; For LSD designs use maximum  $\phi = 0.40$
  - The Nominal Load values are by engineering analysis based on flexural test results.
  - Nominal uplift capacity based upon the worst case of panel flexure, pull-over of a #8 wafer head screw with a head diameter of 0.306" [7.77mm], and #8 screw withdrawal from minimum 16ga with a minimum yield strength of 50 ksi. Screw nominal withdrawal capacity taken as 513 pounds based on AISI S100 Section E4.
- \* Blocking at all joints perpendicular to framing to be minimum 16 ga [54mil] or 0.0538" [1.438mm] thick 3-5/8" track. For sheathing installation where a single span condition exists, additional track blocking is required perpendicular to the framing located mid way between the edges of the panel. See Detail 1.



**Detail 1 - Blocking Detail for 32"[813mm] & 48"[1219mm] o.c. Span Rating (Isometric View)**

**Table 4 - Safety Factors and Resistance Factors for Diaphragms**  
**USG Structural Panel Concrete Roof Deck**

Framing Type	Fastener Type	Earthquake			Wind		
		$\Omega$ (ASD)	$\phi$ (LRFD)	$\phi$ (LSD) <sup>4</sup>	$\Omega$ (ASD)	$\phi$ (LRFD)	$\phi$ (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:**

- Safety factors and resistance factors for USG Structural Panel Concrete Roof Deck diaphragms installed over cold-formed and hot-rolled steel framing are based upon Table D5 of AISI S100-2007.
- Safety factors and resistance factors for USG Structural Panel Concrete Roof Deck 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.
- 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.
- 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 Roof Deck**

Fastener Spacing			Joist Spacing	Screw Pattern <sup>2,3,4,5</sup>	Panel Blocking	S <sub>u</sub> Ultimate Strength (plf) <sup>1</sup>	X	Aspect Ratio
Diaphragm Perimeter	Panel Perimeter	Field						
4" [102mm]	4" [102mm]	12" [305mm]	16" [406mm]	B	None	1462 [21.3 kN/m]	0.443	3:1
6" [152mm]	6" [152mm]					1395 [20.4 kN.m]		
4" [102mm]	4" [102mm]	12" [305mm]	24" [610mm]	B	None	1341 [19.6 kNm]	0.476	3:1
6" [152mm]	6" [152mm]					1053 [15.4 kNm]		
6" [152mm]	6" [152mm]	12" [305mm]	24" [610mm]	C	4" [102mm] wide x 16ga.[1.438mm] Strap	1468 [21.4 kNm]	0.180	4:1
4" [102mm]	4" [102mm]	12" [305mm]	32" or 48" [813mm or 1219mm]	D	4" [102mm] wide x 16ga.[1.438mm] C-Track	2036 [29.7 kNm]	0.415	2.1:1
8" [203mm]	8" [203mm]	12" [305mm]	32" or 48" [813mm or 1219mm]	E	4" [102mm] wide x 16ga.[1.438mm] C-Track	1318 [19.2 kNm]	0.301	2.1:1
2" [102mm]	6" [152mm]	12" [305mm]	24" [610mm]	F	4" [102mm] wide x 16ga.[1.438mm] Strap	1,999 [29.1 kNm]	0.218	4:1
2" [152mm]	4" [102mm]					2,541 [37.0 kNm]		

**Notes:**

1. Refer to Table 4 of this PER for applicable diaphragm safety (Ω) and load resistance factors (ϕ) corresponding to ASD, LRFD, and/or LSD design methods.
2. **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 joints, where the framing joists are perpendicular to the joint, one (1) panel fastener is required. One fastener should be 1" [25mm] from the panel edge.
3. **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 .
4. **Screw Pattern D** - Panels shall be fastened as described in Screw Pattern B with the addition of fasteners at 4" [102mm] o.c. along the metal C-Track Blocking on both sides of seam. When framing is spaced at 32" o.c., 4" [102mm] by 16ga. [1.438mm] strap blocking may be used in place of the C-Track blocking.
5. **Screw Pattern E** - Panels shall be fastened as described in Screw Pattern B with the addition of fasteners at 8" [203mm] o.c. along the metal C-Track Blocking on both sides of seam. When framing is spaced at 32" o.c., 4" [102mm] by 16ga. [1.438mm] strap blocking may be used in place of the C-Track blocking.
6. **Screw Pattern F** - Panels shall be fastened as described in Screw Pattern C with the addition of fasteners at 2" [51mm] o.c. around the entire Diaphragm Perimeter.

**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 Roof Deck for shear, 285,714 psi  
 t = Effective thickness of USG Structural Panel Concrete Roof Deck for shear, 0.73 in.  
 e<sub>n</sub> = Screw joint slippage at load per screw on perimeter of interior panel  
 e<sub>n</sub> @ 0.20S<sub>u</sub> = 0.011  
 e<sub>n</sub> @ 0.33S<sub>u</sub> = 0.019  
 e<sub>n</sub> @ 0.60S<sub>u</sub> = 0.032  
 e<sub>n</sub> @ S<sub>u</sub> = 0.084

X = Slip Co-efficient. See Table 5 above.

**Table 6: Cantilever Diaphragm Testing**  
**USG Structural Panel Concrete Roof Deck**

Fastener Spacing		Joist Spacing	Screw Pattern <sup>3,4,5,6</sup>	Panel Blocking	S <sub>u</sub> Ultimate Strength (plf) <sup>1</sup>	X
Perimeter	Field					
6" [152mm]	12" [305mm]	24" [610mm]	B	None	487 [7.1 kN/m]	0.518
8" [203mm]	12" [305mm]	24" [610mm]	B	None	475 [6.9 kN/m]	0.511
4" [102mm]	12" [305mm]	24" [610mm]	A	None	713 [10.4 kN/m]	0.732
6" [152mm]	12" [305mm]				525 [7.7 kN/m]	0.625
8" [203mm]	12" [305mm]				465 [6.8 kN/m]	0.754
4" [102mm]	12" [305mm]	16" [406mm]	A	None	975 [14.2 kN/m]	0.833
6" [152mm]	12" [305mm]				915 [13.4 kN/m]	0.765
8" [203mm]	12" [305mm]				860 [12.6 kN/m]	0.702
4" [102mm]	12" [305mm]	12" [305mm]	A	None	1121 [16.4 kN/m]	0.759
6" [152mm]	12" [305mm]				940 [13.7 kN/m]	0.541
8" [203mm]	12" [305mm]				772 [11.3 kN/m]	0.484
6" [152mm]	12" [305mm]	24" [610mm]	C	4" [102mm] wide x 16ga. [1.438mm] Strap	1148 [19.8 kN/m]	0.354
4" [102mm]	12" [305mm]	32" or 48" [813mm or 1219mm]	D	4" [102mm] wide x 16ga. [1.438mm] C-Track	1641 [23.9 kN/m]	0.426
8" [203mm]	12" [305mm]	32" or 48" [813mm or 1219mm]	E	4" [102mm] wide x 16ga. [1.438mm] C-Track	1098 [16.0 kN/m]	0.391

**Notes:**

1. Refer to Table 4 of this PER for applicable diaphragm safety (Ω) and load resistance factors (φ) corresponding to ASD, LRFD, and/or LSD design methods.
2. 2 to 1 maximum Aspect Ratio
3. **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.
4. **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 .
5. **Screw Pattern D** - Panels shall be fastened as described in Screw Pattern B with the addition of fasteners at 4" [102mm] o.c. along the C-Track Blocking on both sides of seam. When framing is spaced at 32" o.c., 4" [102mm] by 16ga. [1.438mm] strap blocking may be used in place of the C-Track blocking.
6. **Screw Pattern E** - Panels shall be fastened as described in Screw Pattern B with the addition of fasteners at 8" [203mm] o.c. along the C-Track Blocking on both sides of seam. When framing is spaced at 32" o.c., 4" [102mm] by 16ga. [1.438mm] strap blocking may be used in place of the C-Track blocking.

**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 Roof Deck for shear, 285,714 psi

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

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

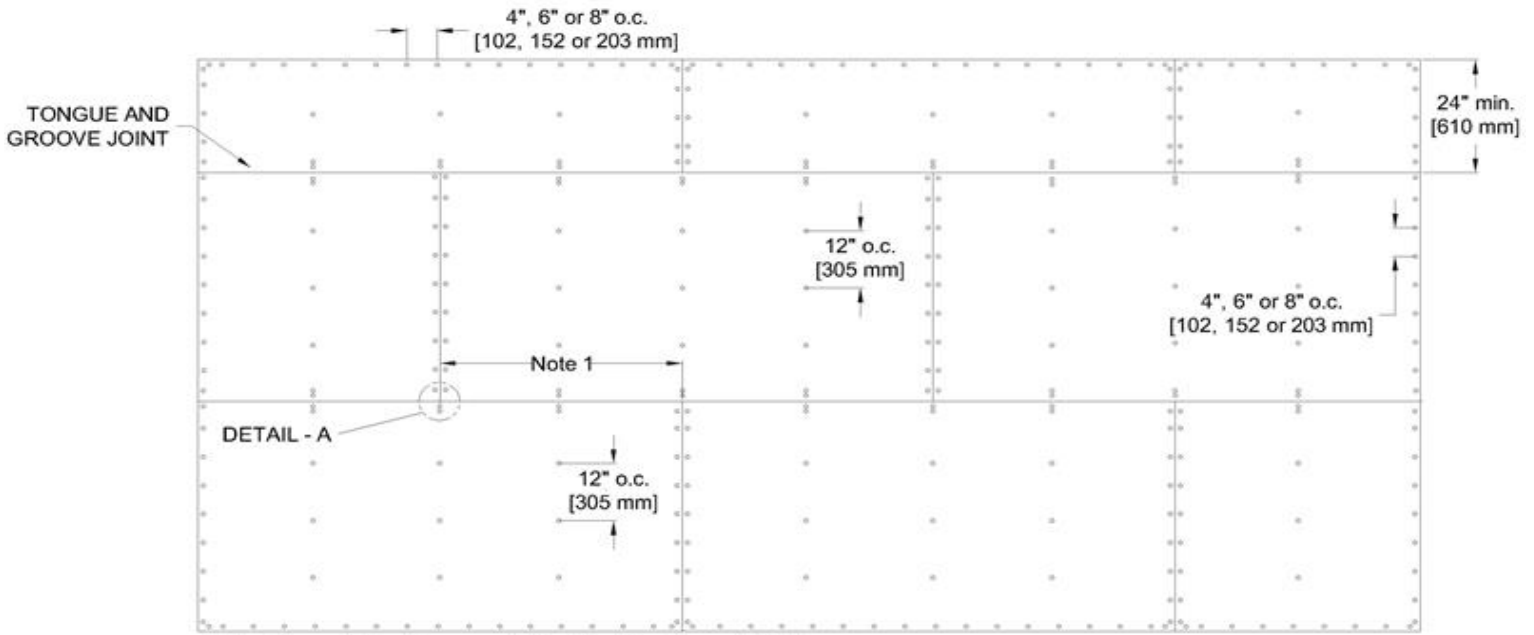
$$e_n @ 0.20S_u = 0.011$$

$$e_n @ 0.33S_u = 0.019$$

$$e_n @ 0.60S_u = 0.032$$

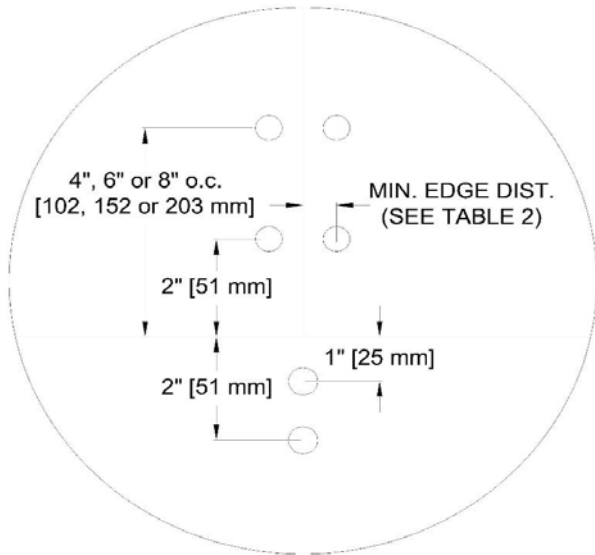
$$e_n @ S_u = 0.084$$

X = Slip Co-efficient. See Table 6 above.

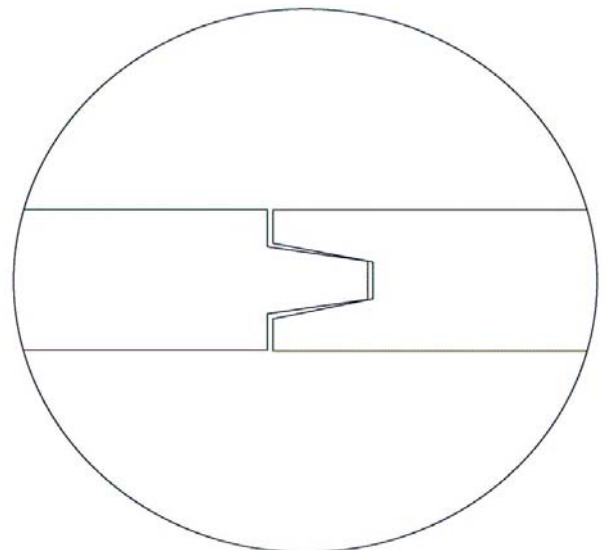


1. Two Span offset of Seams w/o Blocking, One Span w/ Blocking.

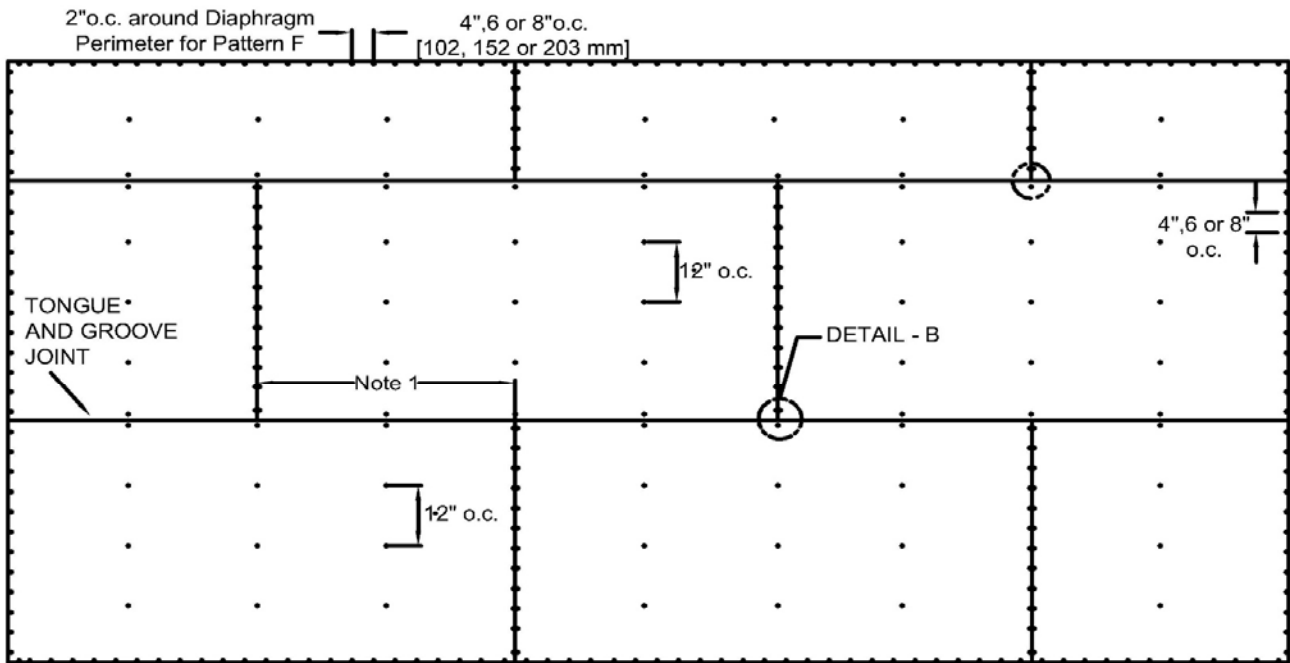
## Screw Pattern A



DETAIL - A

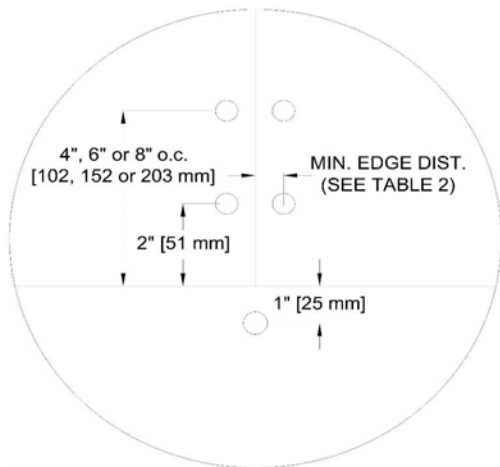


Tongue & Groove

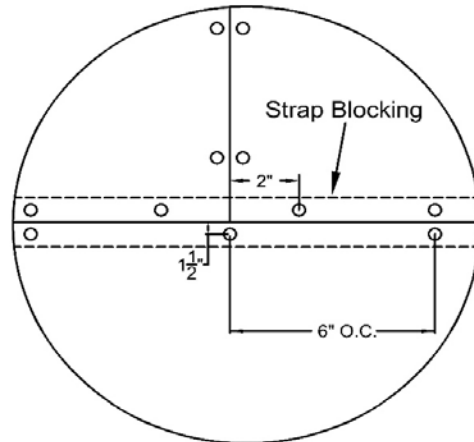


1. Two Span Minimum offset of Seams w/o Blocking, One Span offset w/ Blocking.

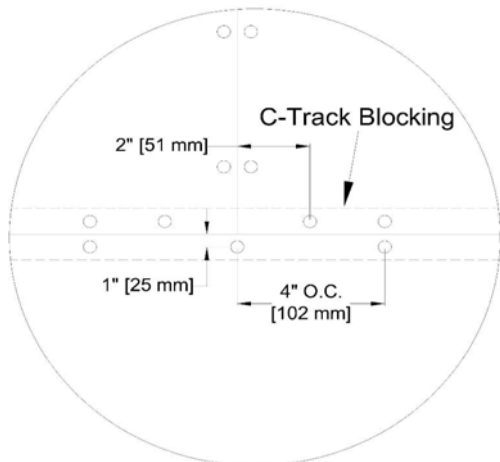
### Screw Pattern B & F



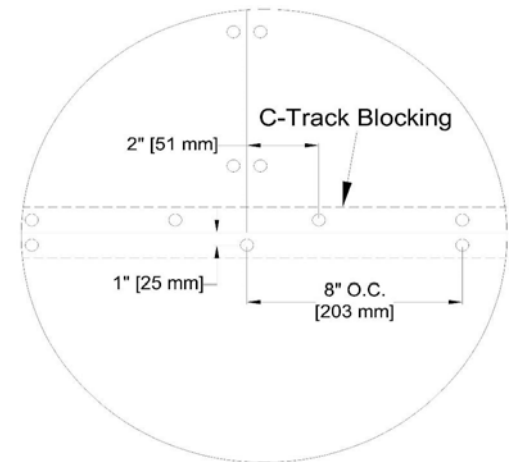
DETAIL -B



Strap Block Detail for Screw Pattern C & F



C-Track Block Detail for Screw Pattern D



C-Track Block Detail for Screw Pattern E