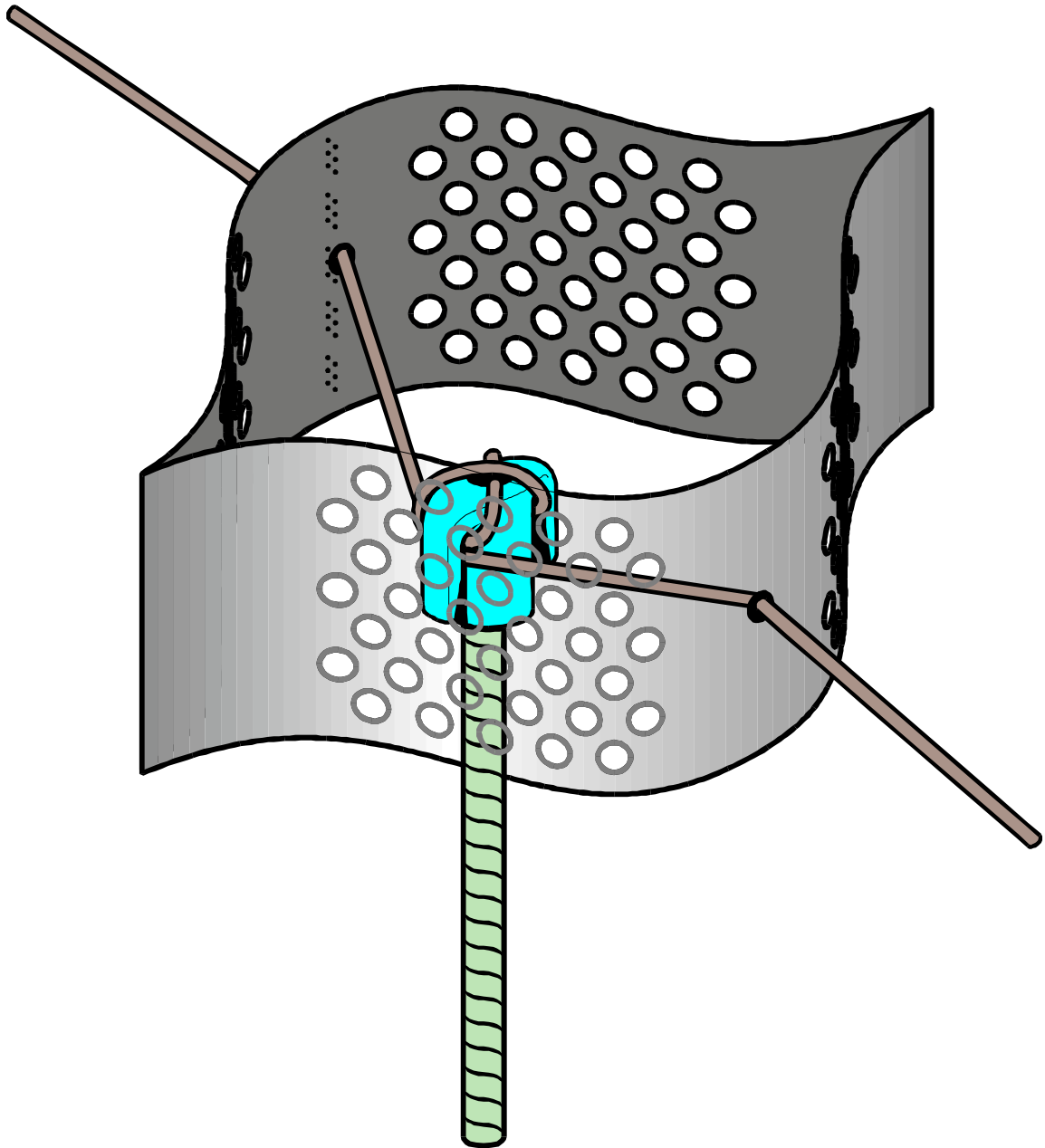




GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION





GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

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GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Manufacturing Certification

Presto Products Company (the manufacturer) shall have earned ISO 9002 certification for its quality-management system at its Geoweb (geocell) cellular confinement system manufacturing plant.

Product Certification

Presto Products Company (the manufacturer) shall provide certification of compliance to all applicable testing procedures and related specifications upon the customer's written request. Request for certification shall be submitted no later than the date of order placement.

Product Warranty

Presto Products Company (the manufacturer) shall warrant each Geoweb cellular confinement system section that it ships to be free from defects in materials and workmanship at the time of manufacture. Presto's exclusive liability under this warranty or otherwise will be to furnish without charge to Presto's customer at the original f.o.b. point a replacement for any section which proves to be defective under normal use and service during the **10-year period** which begins on the date of shipment by Presto. Presto reserves the right to inspect any allegedly defective section in order to verify the defect and ascertain its cause.

This warranty shall not cover defects attributable to causes or occurrences beyond Presto's control and unrelated to the manufacturing process, including, but not limited to, abuse, misuse, mishandling, neglect, improper storage, improper installation, improper alteration or improper application.

PRESTO MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OR MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, IN CONNECTION WITH THE GEOWEB CELLULAR CONFINEMENT SYSTEM. In no event shall Presto be liable for any special, indirect, incidental or consequential damages for the breach of any express or implied warranty or for any other reason, including negligence, in connection with the Geoweb cellular confinement system.

Specifier Choice for Certification and Warranty

The Specifier shall determine the applicability of Manufacturing Certification, Product Certification and a Product Warranty and state which of the above is to be part of the project specifications.

Disclaimer

This document has been prepared for the benefit of customers interested in the Presto Geoweb Cellular Confinement System. It was reviewed carefully prior to publication. Presto Products Company assumes no liability and makes no guarantee or warranty as to its accuracy or completeness. Final determination of the suitability of any information or material for the use contemplated, or for its manner of use, is the sole responsibility of the user. Geoweb® is a registered trademark of Presto Products Company.



GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Geoweb Base Material

NOTE: All measurements and colorants are subject to manufacturing tolerances unless otherwise stated.

Polyethylene - Stabilized with Carbon Black

Polyethylene used to make strips for Presto Geoweb sections shall have a density of 0.935 - 0.965 g/cm³ (58.4 - 60.2 lb/ft³) tested per ASTM D1505.

Polyethylene used to make strips for Presto Geoweb sections shall have an Environmental Stress Crack Resistance (ESCR) of 3000 hour tested per ASTM D1693.

Carbon black shall be used for ultra-violet light stabilization. Carbon black content shall be 1.5% - 2% by weight through the addition of a carrier with a certified carbon black content. The carbon black shall be homogeneously distributed throughout the material.

The resin manufacturer's certification of polyethylene density and ESCR shall be available upon request from Presto (the Geoweb manufacturer). Presto shall certify the percentage of carbon black.

Polyethylene - Colored and Stabilized with HALS

Polyethylene used to make strips for Presto Geoweb sections shall have a density of 0.935 - 0.965 g/cm³ (58.4 - 60.2 lb/ft³) tested per ASTM D1505.

Polyethylene used to make strips for Presto Geoweb sections shall have an Environmental Stress Crack Resistance (ESCR) of 3000 hour tested per ASTM D1693.

The color(s) of the polyethylene shall be (Tan, Green, other). Colorants shall be non-heavy metal types. The colorant shall be homogeneously distributed throughout the material.

Hindered amine light stabilizer (HALS) shall be used for ultra-violet light stabilization. HALS content shall be 1.0% by weight through the addition of a carrier with a certified HALS concentrate. The HALS shall be homogeneously distributed throughout the material.

The resin manufacturer's certification of polyethylene density and ESCR shall be available upon request from Presto (the Geoweb manufacturer). Presto shall certify the percentage of HALS.

Specifier Choice for Base Material

The polyethylene used for all Geoweb material meets the same standards. The specifier shall state the desired color. The color determines which ultraviolet light stabilizer is to be used. Polyethylene stabilized with carbon black is used for most applications. Colored polyethylene stabilized with HALS is generally used for the fascia strip for Geoweb earth retention systems.



GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Strip Properties and Assembly

NOTE: All measurements are subject to manufacturing tolerances unless otherwise stated.

Perforated Textured Strip/Cell (Recommended)

Polyethylene sheet used to make strips for Presto Geoweb sections shall have a thickness of 1.27 mm -5% +10% (50 mil -5% +10%) prior to any surface disruption. The strips shall have a perforated, textured surface. **Performance:** The peak friction angle between the surface of the perforated, textured plastic and a #40 silica sand at 100% relative density shall be no less than 85% of the peak friction angle of the silica sand in isolation when tested by the direct shear method per ASTM D 5321. The quantity of perforations shall remove 16% ± 1% of the cell wall area. **Material:** The surface texturing shall be a multitude of rhomboidal (diamond shape) indentations. The rhomboidal indentations shall have a surface density of 22 - 31 per cm² (140 - 200 per in²). The thickness of the textured sheet shall be 1.52 mm ±0.15 mm (60 mil ±6 mil) determined per ASTM D5199. The perforations shall be horizontal rows of 10 mm (0.391 in) diameter holes. Perforations within each row shall be 19 mm (0.75 in) on-center. Horizontal rows shall be staggered and separated 12 mm (0.50 in) relative to the hole centers. The edge of strip to the nearest edge of perforation shall be 8 mm (0.312 in) minimum and the centerline of the spot weld to the nearest edge of perforation shall be 6 mm (0.25 in) minimum.

Non-perforated Textured Strip/Cell

Polyethylene sheet used to make strips for Presto Geoweb sections shall have a thickness of 1.27 mm -5% +10% (50 mil -5% +10%) prior to any surface disruption. The strips shall have a textured surface. **Performance:** The peak friction angle between the surface of the textured plastic and a #40 silica sand at 100% relative density shall be no less than 85% of the peak friction angle of the silica sand in isolation when tested by the direct shear method per ASTM D 5321. **Material:** The surface texturing shall be a multitude of rhomboidal (diamond shape) indentations. The rhomboidal indentations shall have a surface density of 22 - 31 per cm² (140 - 200 per in²). The thickness of the textured sheet shall be 1.52 mm ±0.15 mm (60 mil ±6 mil) determined per ASTM D5199.

Assembly

Presto Geoweb [Cell Type] sections shall be fabricated using strips of sheet polyethylene each having a length of ... (per Table 1) and a width equal to the cell depth. Polyethylene strips shall be connected using uniformly-spaced, full-depth, ultrasonic spot-welds. Welds shall be offset and aligned perpendicular to the longitudinal axis of the strip. Weld spacing shall be ... (per Table 1). The ultrasonic weld melt-pool width shall not exceed 25 mm (1.0 in).

Table 1 Strip Lengths & Weld Spacing for Cell Types

Cell Type	GW20	GW40
Strip Length	3.35 m (132 in)	3.35 m (132 in)
Weld Spacing	330 mm ± 2.5 mm (13.0 in ± 0.10 in)	660 mm ±2.5 mm (26.0 in ± 0.10 in)

Specifier Choice for Strip Properties and Assembly

The specifier shall state the desired strip/cell type: Perforated Textured or Non-Perforated Textured and use either the **Performance** or **Material** language. Refer to *THE GEOWEB SYSTEM TECHNICAL OVERVIEW* documents for recommendations.



GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Cell and Seam Properties

NOTE: All measurements are nominal and subject to manufacturing tolerances unless otherwise stated.

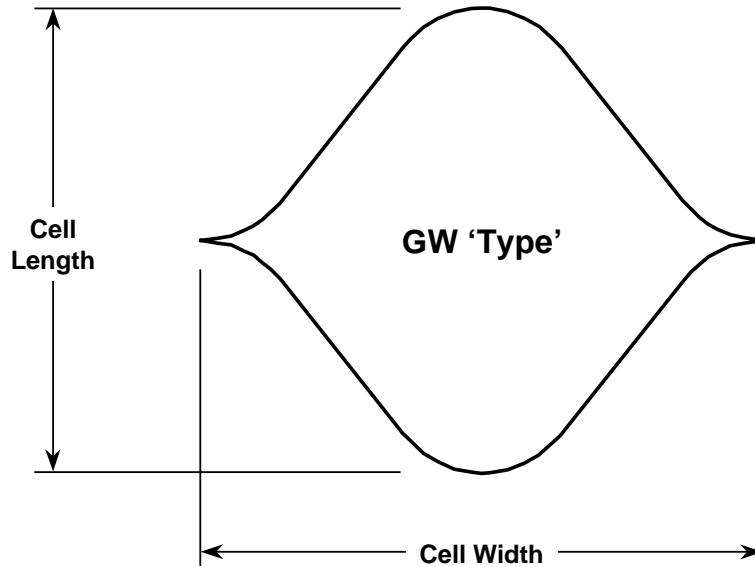


Figure 1 Expanded Geoweb Cell

Cell Length, Width and Area

The individual cells of the GW(TT) Geoweb section shall be uniform in shape and size when expanded. The nominal cell dimensions shall be of length (LL) and width (WW). Individual cells shall have a nominal area of (AA). See Figure 1.

Type (TT)	Length (LL)	Width (WW)	Area (AA)
GW20	200 mm (8.0 in)	240 mm (9.6 in)	240 cm ² (38 in ²)
GW40	400 mm (16.0 in)	480 mm (19.2 in)	960 cm ² (153 in ²)

Cell Depth

The Geoweb section shall have a nominal cell depth of (DD).

Depth (DD) =	200 mm (8.0 in)	150 mm (6.0 in)	100 mm (4.0 in)	75 mm (3.0 in)
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GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Cell Seam Peel Strength Test

NOTE: All measurements are subject to manufacturing tolerances unless otherwise stated.

Short-Term Seam Peel-Strength Test

Cell seam strength shall be uniform over the full depth of the cell. Short-term peel strength shall be tested per U.S. Army Corps of Engineers Technical Report GL-86-19, Appendix A. See Figure 2. Minimum seam peel strengths shall be...

- 2000 N (450 lbf) for the 200 mm (8.0 in) depth cell.
- 1420 N (320 lbf) for the 150 mm (6.0 in) depth cell.
- 1000 N (225 lbf) for the 100 mm (4.0 in) depth cell.
- 710 N (160 lbf) for the 75 mm (3.0 in) depth cell.

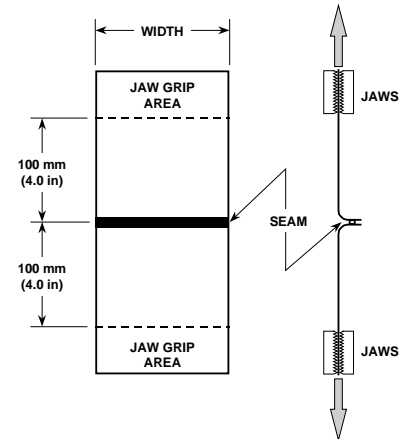


Figure 2 Seam Peel Strength Test

Long-Term Seam Hang-Strength Test

Seam hang-strength test shall be performed for a period of **7 days minimum** in a temperature-controlled environment that undergoes change on a 1-hour cycle from room temperature to 54°C (130°F). Room temperature is defined in ASTM E41. Test samples shall be made by welding two 100 mm (4.0 in) wide polyethylene strips together. A test sample consisting of two carbon-black stabilized strips shall support a 72.5 kg (160 lb) load for the test period. A test sample consisting of a carbon black stabilized strip and a HALS stabilized strip shall support a 63.5 kg (140 lb) load for the test period.

Alternative Long-Term Seam Hang-Strength Test

Seam hang-strength test shall be performed for a period of **30 days minimum** at room temperature. Room temperature is defined in ASTM E41. Test samples shall be made by welding two 100 mm (4.0 in) wide polyethylene strips together. A test sample consisting of two carbon-black stabilized strips shall support a 72.5 kg (160 lb) load for the test period. A test sample consisting of a carbon black stabilized strip and a HALS stabilized strip shall support a 63.5 kg (140 lb) load for the test period.

Specifier Choice for Seam and Cell Properties

The specifier shall state the desired cell size: either the GW20 or GW40 Geoweb section and the cell depth. Refer to *THE GEOWEB SYSTEM TECHNICAL OVERVIEW* documents for recommendations.

The specifier shall also state the Short-Term Seam Peel-Strength Test and either the Long-Term Seam Hang-Strength Test (recommended) or the Alternative Long-Term Seam Hang-Strength Test. There are three possibilities for seams for a Geoweb section. First, is two carbon black stabilized strips welded together. This is most typical for Geoweb sections used in all application areas. Second, is a carbon black strip welded to a HALS stabilized strip. This is typically used when a colored facia is desired on the Geoweb earth retention system. Third, is two HALS stabilized strips welded together. However, this is uncommon and would apply only to fully colored Geoweb sections. Presto should be consulted before specifying fully colored Geoweb sections. In the Long Term and the Alternative Long Term Seam Hang-Strength Test, the load capacity is given for seams made of two carbon black stabilized strips welded together and a carbon black stabilized strip welded to a HALS stabilized strip.



GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Geoweb Section Properties – GW20 Cell

NOTE: All measurements are subject to manufacturing tolerances unless otherwise stated.

GW20 Geoweb Section

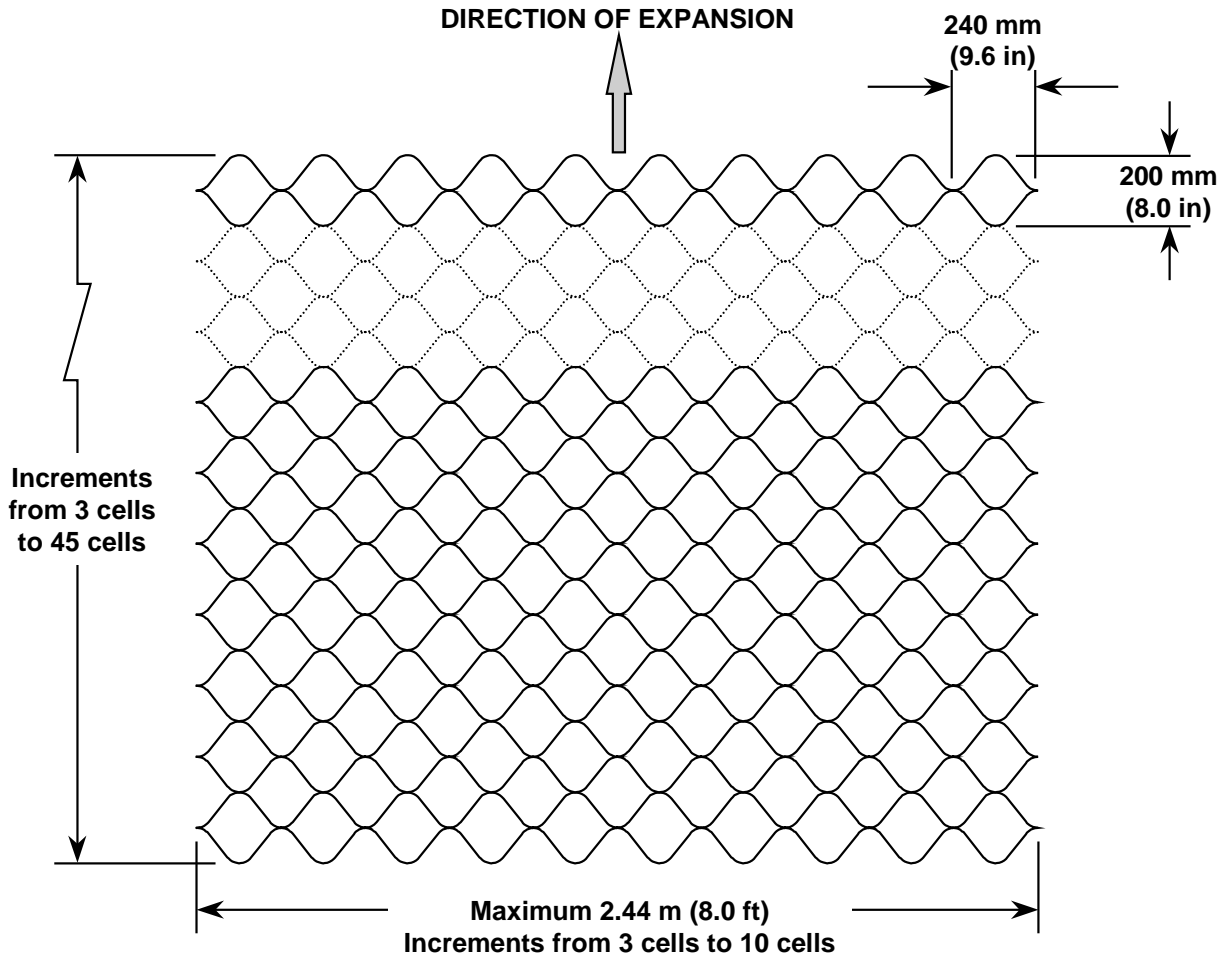


Figure 3 GW20 Geoweb Section

Presto Geoweb GW20 section dimensions shall be as indicated in Figure 3. Sections shall have a nomenclature of "GW20DDWWLL" where "GW20" indicates the cell size, "DD" indicates the cell depth in inches, "WW" indicates the number of cells wide, and "LL" indicates the number of cells long. Sections shall have expanded dimensions and weights per Table 2. An example of the GW20 Geoweb section nomenclature is GW20081030 where the section cell depth is 8.0 in or 200 mm and the section is 10 cells wide and 30 cells in length.



GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Table 2 GW20 Perforated Geoweb Sections - Dimensions & Weights for Maximum Width Section

GW20 Geoweb Section	Length		Width (10 cells)		Area		Weight per Section, kg (lb)							
	m	(ft)	m	(ft)	m ²	(ft ²)	Where DD = 03	Where DD = 04	Where DD = 06	Where DD = 08				
GW20 DD 10 03	0.61	(2.0)	2.44	(8.0)	1.49	(16.0)	1.56	(3.5)	2.11	(4.7)	3.13	(6.9)	4.22	(9.3)
GW20 DD 10 04	0.81	(2.7)	2.44	(8.0)	1.98	(21.3)	2.09	(4.6)	2.81	(6.2)	4.17	(9.2)	5.62	(12.4)
GW20 DD 10 05	1.02	(3.3)	2.44	(8.0)	2.48	(26.7)	2.61	(5.8)	3.52	(7.8)	5.22	(11.5)	7.03	(15.5)
GW20 DD 10 06	1.22	(4.0)	2.44	(8.0)	2.97	(32.0)	3.13	(6.9)	4.22	(9.3)	6.26	(13.8)	8.44	(18.6)
GW20 DD 10 07	1.42	(4.7)	2.44	(8.0)	3.47	(37.3)	3.65	(8.1)	4.92	(10.9)	7.30	(16.1)	9.84	(21.7)
GW20 DD 10 08	1.63	(5.3)	2.44	(8.0)	3.96	(42.7)	4.17	(9.2)	5.62	(12.4)	8.35	(18.4)	11.25	(24.8)
GW20 DD 10 09	1.83	(6.0)	2.44	(8.0)	4.46	(48.0)	4.69	(10.4)	6.33	(14.0)	9.39	(20.7)	12.66	(27.9)
GW20 DD 10 10	2.03	(6.7)	2.44	(8.0)	4.95	(53.3)	5.22	(11.5)	7.03	(15.5)	10.43	(23.0)	14.06	(31.0)
GW20 DD 10 11	2.24	(7.3)	2.44	(8.0)	5.45	(58.7)	5.74	(12.7)	7.73	(17.1)	11.48	(25.3)	15.47	(34.1)
GW20 DD 10 12	2.44	(8.0)	2.44	(8.0)	5.95	(64.0)	6.26	(13.8)	8.44	(18.6)	12.52	(27.6)	16.87	(37.2)
GW20 DD 10 13	2.64	(8.7)	2.44	(8.0)	6.44	(69.3)	6.78	(15.0)	9.14	(20.2)	13.56	(29.9)	18.28	(40.3)
GW20 DD 10 14	2.84	(9.3)	2.44	(8.0)	6.94	(74.7)	7.30	(16.1)	9.84	(21.7)	14.61	(32.2)	19.69	(43.4)
GW20 DD 10 15	3.05	(10.0)	2.44	(8.0)	7.43	(80.0)	7.82	(17.3)	10.55	(23.3)	15.65	(34.5)	21.09	(46.5)
GW20 DD 10 16	3.25	(10.7)	2.44	(8.0)	7.93	(85.3)	8.35	(18.4)	11.25	(24.8)	16.69	(36.8)	22.50	(49.6)
GW20 DD 10 17	3.45	(11.3)	2.44	(8.0)	8.42	(90.7)	8.87	(19.6)	11.95	(26.4)	17.74	(39.1)	23.90	(52.7)
GW20 DD 10 18	3.66	(12.0)	2.44	(8.0)	8.92	(96.0)	9.39	(20.7)	12.66	(27.9)	18.78	(41.4)	25.31	(55.8)
GW20 DD 10 19	3.86	(12.7)	2.44	(8.0)	9.41	(101.3)	9.91	(21.9)	13.36	(29.5)	19.82	(43.7)	26.72	(58.9)
GW20 DD 10 20	4.06	(13.3)	2.44	(8.0)	9.91	(106.7)	10.43	(23.0)	14.06	(31.0)	20.87	(46.0)	28.12	(62.0)
GW20 DD 10 21	4.27	(14.0)	2.44	(8.0)	10.41	(112.0)	10.95	(24.2)	14.76	(32.6)	21.91	(48.3)	29.53	(65.1)
GW20 DD 10 22	4.47	(14.7)	2.44	(8.0)	10.90	(117.3)	11.48	(25.3)	15.47	(34.1)	22.95	(50.6)	30.93	(68.2)
GW20 DD 10 23	4.67	(15.3)	2.44	(8.0)	11.40	(122.7)	12.00	(26.5)	16.17	(35.7)	24.00	(52.9)	32.34	(71.3)
GW20 DD 10 24	4.88	(16.0)	2.44	(8.0)	11.89	(128.0)	12.52	(27.6)	16.87	(37.2)	25.04	(55.2)	33.75	(74.4)
GW20 DD 10 25	5.08	(16.7)	2.44	(8.0)	12.39	(133.3)	13.04	(28.8)	17.58	(38.8)	26.08	(57.5)	35.15	(77.5)
GW20 DD 10 26	5.28	(17.3)	2.44	(8.0)	12.88	(138.7)	13.56	(29.9)	18.28	(40.3)	27.12	(59.8)	36.56	(80.6)
GW20 DD 10 27	5.49	(18.0)	2.44	(8.0)	13.38	(144.0)	14.08	(31.1)	18.98	(41.9)	28.17	(62.1)	37.97	(83.7)
GW20 DD 10 28	5.69	(18.7)	2.44	(8.0)	13.87	(149.3)	14.61	(32.2)	19.69	(43.4)	29.21	(64.4)	39.37	(86.8)
GW20 DD 10 29	5.89	(19.3)	2.44	(8.0)	14.37	(154.7)	15.13	(33.4)	20.39	(45.0)	30.25	(66.7)	40.78	(89.9)
GW20 DD 10 30	6.10	(20.0)	2.44	(8.0)	14.86	(160.0)	15.65	(34.5)	21.09	(46.5)	31.30	(69.0)	42.18	(93.0)
GW20 DD 10 31	6.30	(20.7)	2.44	(8.0)	15.36	(165.3)	16.17	(35.7)	21.80	(48.1)	32.34	(71.3)	43.59	(96.1)
GW20 DD 10 32	6.50	(21.3)	2.44	(8.0)	15.86	(170.7)	16.69	(36.8)	22.50	(49.6)	33.38	(73.6)	45.00	(99.2)
GW20 DD 10 33	6.71	(22.0)	2.44	(8.0)	16.35	(176.0)	17.21	(38.0)	23.20	(51.2)	34.43	(75.9)	46.40	(102.3)
GW20 DD 10 34	6.91	(22.7)	2.44	(8.0)	16.85	(181.3)	17.74	(39.1)	23.90	(52.7)	35.47	(78.2)	47.81	(105.4)
GW20 DD 10 35	7.11	(23.3)	2.44	(8.0)	17.34	(186.7)	18.26	(40.3)	24.61	(54.3)	36.51	(80.5)	49.21	(108.5)
GW20 DD 10 36	7.32	(24.0)	2.44	(8.0)	17.84	(192.0)	18.78	(41.4)	25.31	(55.8)	37.56	(82.8)	50.62	(111.6)
GW20 DD 10 37	7.52	(24.7)	2.44	(8.0)	18.33	(197.3)	19.30	(42.6)	26.01	(57.4)	38.60	(85.1)	52.03	(114.7)
GW20 DD 10 38	7.72	(25.3)	2.44	(8.0)	18.83	(202.7)	19.82	(43.7)	26.72	(58.9)	39.64	(87.4)	53.43	(117.8)
GW20 DD 10 39	7.92	(26.0)	2.44	(8.0)	19.32	(208.0)	20.34	(44.9)	27.42	(60.5)	40.69	(89.7)	54.84	(120.9)
GW20 DD 10 40	8.13	(26.7)	2.44	(8.0)	19.82	(213.3)	20.87	(46.0)	28.12	(62.0)	41.73	(92.0)	56.25	(124.0)
GW20 DD 10 41	8.33	(27.3)	2.44	(8.0)	20.31	(218.7)	21.39	(47.2)	28.83	(63.6)	42.77	(94.3)	57.65	(127.1)
GW20 DD 10 42	8.53	(28.0)	2.44	(8.0)	20.81	(224.0)	21.91	(48.3)	29.53	(65.1)	43.82	(96.6)	59.06	(130.2)
GW20 DD 10 43	8.74	(28.7)	2.44	(8.0)	21.31	(229.3)	22.43	(49.5)	30.23	(66.7)	44.86	(98.9)	60.46	(133.3)
GW20 DD 10 44	8.94	(29.3)	2.44	(8.0)	21.80	(234.7)	22.95	(50.6)	30.93	(68.2)	45.90	(101.2)	61.87	(136.4)
GW20 DD 10 45	9.14	(30.0)	2.44	(8.0)	22.30	(240.0)	23.47	(51.8)	31.64	(69.8)	46.95	(103.5)	63.28	(139.5)

NOTE: To obtain non-perforated Geoweb section weights increase table weights by approximately 16% ±1%.



GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Geoweb Section Properties – GW40 Cell

NOTE: All measurements are subject to manufacturing tolerances unless otherwise stated.

GW40 Geoweb Section

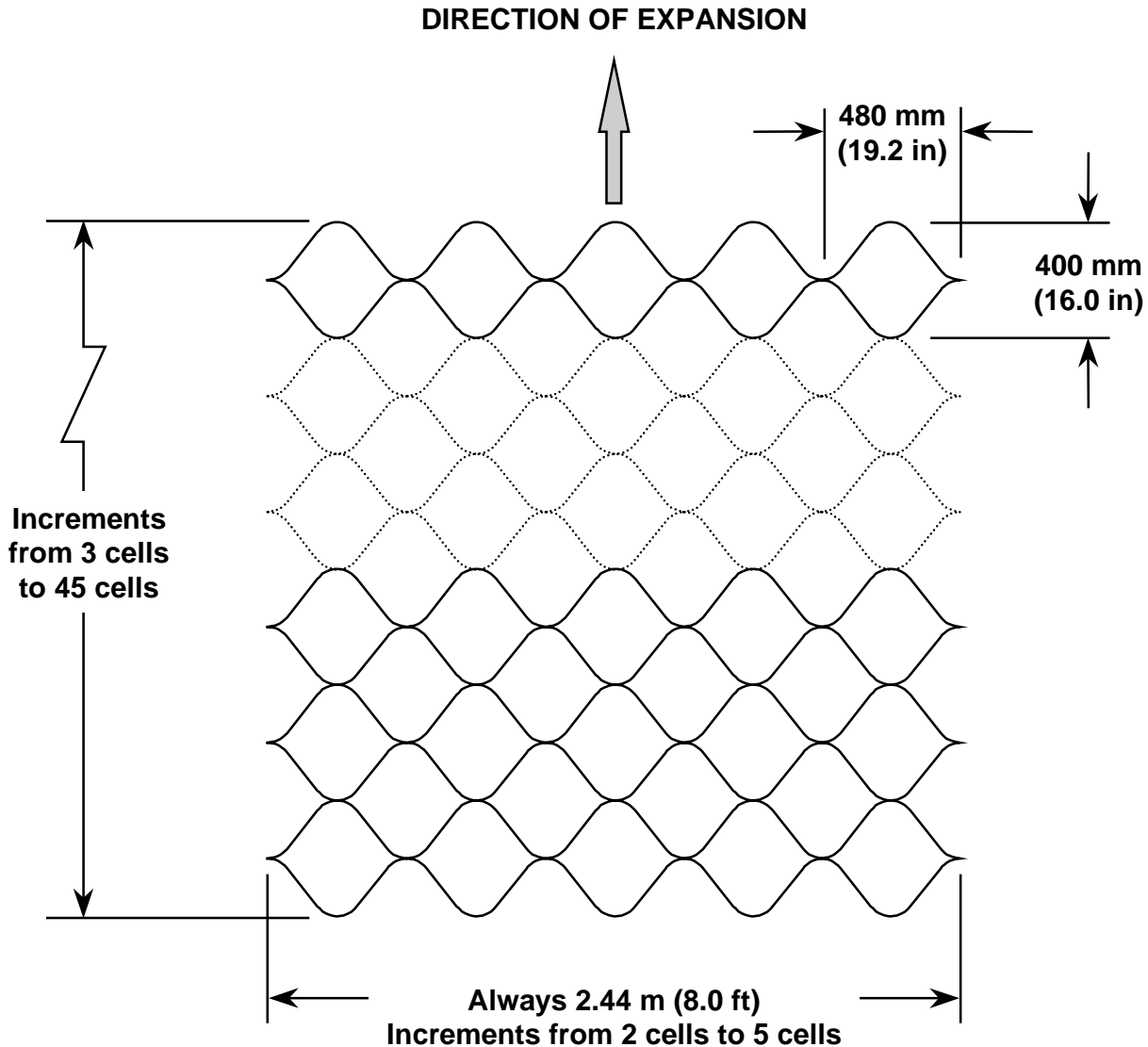


Figure 4 GW40 Geoweb Section

Presto Geoweb GW40 section dimensions shall be as indicated in Figure 4. Sections shall have a nomenclature of "GW40DDWWLL" where "GW40" indicates the cell size, "DD" indicates the cell depth in inches, "WW" indicates the number of cells wide, and "LL" indicates the number of cells long. Sections shall have expanded dimensions and weights per Table 3. An example of the GW40 Geoweb section nomenclature is GW40080530 where the section cell depth is 8.0 in or 200 mm and the section is 5 cells wide and 30 cells in length.



GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Table 3 GW40 Perforated Geoweb Sections - Dimensions & Weights for Maximum Width Section

GW40 Geoweb Section		Length		Width (05 cells)		Area		Weight per Section, kg (lb)						
		m	(ft)	m	(ft)	m ²	(ft ²)	Where DD = 03	Where DD = 04	Where DD = 06	Where DD = 08			
GW40 DD 5 03	0.61	(2.0)	2.44	(8.0)	1.49	(16.0)	1.56	(3.5)	2.11	(4.7)	3.13	(6.9)	4.22	(9.3)
GW40 DD 5 04	0.81	(2.7)	2.44	(8.0)	1.98	(21.3)	2.09	(4.6)	2.81	(6.2)	4.17	(9.2)	5.62	(12.4)
GW40 DD 5 05	1.02	(3.3)	2.44	(8.0)	2.48	(26.7)	2.61	(5.8)	3.52	(7.8)	5.22	(11.5)	7.03	(15.5)
GW40 DD 5 06	1.22	(4.0)	2.44	(8.0)	2.97	(32.0)	3.13	(6.9)	4.22	(9.3)	6.26	(13.8)	8.44	(18.6)
GW40 DD 5 07	1.42	(4.7)	2.44	(8.0)	3.47	(37.3)	3.65	(8.1)	4.92	(10.9)	7.30	(16.1)	9.84	(21.7)
GW40 DD 5 08	1.63	(5.3)	2.44	(8.0)	3.96	(42.7)	4.17	(9.2)	5.62	(12.4)	8.35	(18.4)	11.25	(24.8)
GW40 DD 5 09	1.83	(6.0)	2.44	(8.0)	4.46	(48.0)	4.69	(10.4)	6.33	(14.0)	9.39	(20.7)	12.66	(27.9)
GW40 DD 5 10	2.03	(6.7)	2.44	(8.0)	4.95	(53.3)	5.22	(11.5)	7.03	(15.5)	10.43	(23.0)	14.06	(31.0)
GW40 DD 5 11	2.24	(7.3)	2.44	(8.0)	5.45	(58.7)	5.74	(12.7)	7.73	(17.1)	11.48	(25.3)	15.47	(34.1)
GW40 DD 5 12	2.44	(8.0)	2.44	(8.0)	5.95	(64.0)	6.26	(13.8)	8.44	(18.6)	12.52	(27.6)	16.87	(37.2)
GW40 DD 5 13	2.64	(8.7)	2.44	(8.0)	6.44	(69.3)	6.78	(15.0)	9.14	(20.2)	13.56	(29.9)	18.28	(40.3)
GW40 DD 5 14	2.84	(9.3)	2.44	(8.0)	6.94	(74.7)	7.30	(16.1)	9.84	(21.7)	14.61	(32.2)	19.69	(43.4)
GW40 DD 5 15	3.05	(10.0)	2.44	(8.0)	7.43	(80.0)	7.82	(17.3)	10.55	(23.3)	15.65	(34.5)	21.09	(46.5)
GW40 DD 5 16	3.25	(10.7)	2.44	(8.0)	7.93	(85.3)	8.35	(18.4)	11.25	(24.8)	16.69	(36.8)	22.50	(49.6)
GW40 DD 5 17	3.45	(11.3)	2.44	(8.0)	8.42	(90.7)	8.87	(19.6)	11.95	(26.4)	17.74	(39.1)	23.90	(52.7)
GW40 DD 5 18	3.66	(12.0)	2.44	(8.0)	8.92	(96.0)	9.39	(20.7)	12.66	(27.9)	18.78	(41.4)	25.31	(55.8)
GW40 DD 5 19	3.86	(12.7)	2.44	(8.0)	9.41	(101.3)	9.91	(21.9)	13.36	(29.5)	19.82	(43.7)	26.72	(58.9)
GW40 DD 5 20	4.06	(13.3)	2.44	(8.0)	9.91	(106.7)	10.43	(23.0)	14.06	(31.0)	20.87	(46.0)	28.12	(62.0)
GW40 DD 5 21	4.27	(14.0)	2.44	(8.0)	10.41	(112.0)	10.95	(24.2)	14.76	(32.6)	21.91	(48.3)	29.53	(65.1)
GW40 DD 5 22	4.47	(14.7)	2.44	(8.0)	10.90	(117.3)	11.48	(25.3)	15.47	(34.1)	22.95	(50.6)	30.93	(68.2)
GW40 DD 5 23	4.67	(15.3)	2.44	(8.0)	11.40	(122.7)	12.00	(26.5)	16.17	(35.7)	24.00	(52.9)	32.34	(71.3)
GW40 DD 5 24	4.88	(16.0)	2.44	(8.0)	11.89	(128.0)	12.52	(27.6)	16.87	(37.2)	25.04	(55.2)	33.75	(74.4)
GW40 DD 5 25	5.08	(16.7)	2.44	(8.0)	12.39	(133.3)	13.04	(28.8)	17.58	(38.8)	26.08	(57.5)	35.15	(77.5)
GW40 DD 5 26	5.28	(17.3)	2.44	(8.0)	12.88	(138.7)	13.56	(29.9)	18.28	(40.3)	27.12	(59.8)	36.56	(80.6)
GW40 DD 5 27	5.49	(18.0)	2.44	(8.0)	13.38	(144.0)	14.08	(31.1)	18.98	(41.9)	28.17	(62.1)	37.97	(83.7)
GW40 DD 5 28	5.69	(18.7)	2.44	(8.0)	13.87	(149.3)	14.61	(32.2)	19.69	(43.4)	29.21	(64.4)	39.37	(86.8)
GW40 DD 5 29	5.89	(19.3)	2.44	(8.0)	14.37	(154.7)	15.13	(33.4)	20.39	(45.0)	30.25	(66.7)	40.78	(89.9)
GW40 DD 5 30	6.10	(20.0)	2.44	(8.0)	14.86	(160.0)	15.65	(34.5)	21.09	(46.5)	31.30	(69.0)	42.18	(93.0)
GW40 DD 5 31	6.30	(20.7)	2.44	(8.0)	15.36	(165.3)	16.17	(35.7)	21.80	(48.1)	32.34	(71.3)	43.59	(96.1)
GW40 DD 5 32	6.50	(21.3)	2.44	(8.0)	15.86	(170.7)	16.69	(36.8)	22.50	(49.6)	33.38	(73.6)	45.00	(99.2)
GW40 DD 5 33	6.71	(22.0)	2.44	(8.0)	16.35	(176.0)	17.21	(38.0)	23.20	(51.2)	34.43	(75.9)	46.40	(102.3)
GW40 DD 5 34	6.91	(22.7)	2.44	(8.0)	16.85	(181.3)	17.74	(39.1)	23.90	(52.7)	35.47	(78.2)	47.81	(105.4)
GW40 DD 5 35	7.11	(23.3)	2.44	(8.0)	17.34	(186.7)	18.26	(40.3)	24.61	(54.3)	36.51	(80.5)	49.21	(108.5)
GW40 DD 5 36	7.32	(24.0)	2.44	(8.0)	17.84	(192.0)	18.78	(41.4)	25.31	(55.8)	37.56	(82.8)	50.62	(111.6)
GW40 DD 5 37	7.52	(24.7)	2.44	(8.0)	18.33	(197.3)	19.30	(42.6)	26.01	(57.4)	38.60	(85.1)	52.03	(114.7)
GW40 DD 5 38	7.72	(25.3)	2.44	(8.0)	18.83	(202.7)	19.82	(43.7)	26.72	(58.9)	39.64	(87.4)	53.43	(117.8)
GW40 DD 5 39	7.92	(26.0)	2.44	(8.0)	19.32	(208.0)	20.34	(44.9)	27.42	(60.5)	40.69	(89.7)	54.84	(120.9)
GW40 DD 5 40	8.13	(26.7)	2.44	(8.0)	19.82	(213.3)	20.87	(46.0)	28.12	(62.0)	41.73	(92.0)	56.25	(124.0)
GW40 DD 5 41	8.33	(27.3)	2.44	(8.0)	20.31	(218.7)	21.39	(47.2)	28.83	(63.6)	42.77	(94.3)	57.65	(127.1)
GW40 DD 5 42	8.53	(28.0)	2.44	(8.0)	20.81	(224.0)	21.91	(48.3)	29.53	(65.1)	43.82	(96.6)	59.06	(130.2)
GW40 DD 5 43	8.74	(28.7)	2.44	(8.0)	21.31	(229.3)	22.43	(49.5)	30.23	(66.7)	44.86	(98.9)	60.46	(133.3)
GW40 DD 5 44	8.94	(29.3)	2.44	(8.0)	21.80	(234.7)	22.95	(50.6)	30.93	(68.2)	45.90	(101.2)	61.87	(136.4)
GW40 DD 5 45	9.14	(30.0)	2.44	(8.0)	22.30	(240.0)	23.47	(51.8)	31.64	(69.8)	46.95	(103.5)	63.28	(139.5)

NOTE: To obtain non-perforated Geoweb section weights increase table weights by approximately 16% ±1%.

Specifier Choice for Section Properties

The specifier shall state the desired Geoweb section type(s) and size(s). Refer to *THE GEOWEB SYSTEM TECHNICAL OVERVIEW* documents for recommendations.



GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Geoweb Section Special Features

NOTE: All measurements are subject to manufacturing tolerances unless otherwise stated.

Geoweb Sections with ATRA™ Notches

Geoweb sections shall have ATRA™ notches to allow the driving of the ATRA™ Anchors and/or J-Pin anchors below the top of the cell wall. ATRA™ notches shall be a 20 mm wide x 20 mm deep ($\frac{3}{4}$ in x $\frac{3}{4}$ in) notch cut into the Geoweb section at the primary weld locations. The vertical center of the notch with respect to the weld shall be located ± 10 mm ($\frac{3}{8}$ in) off the weld line. See Figure 5.

Tendoned Geoweb Sections

Geoweb sections shall be provided with a series of aligned holes through the cell walls for the insertion of tendons. Tendons are inserted in the field such that they pass through the Geoweb section in the direction of expansion. Hole diameter shall be 10 mm (0.375 in) and positioned according to the requirements of the tendon design. See Figure 6.

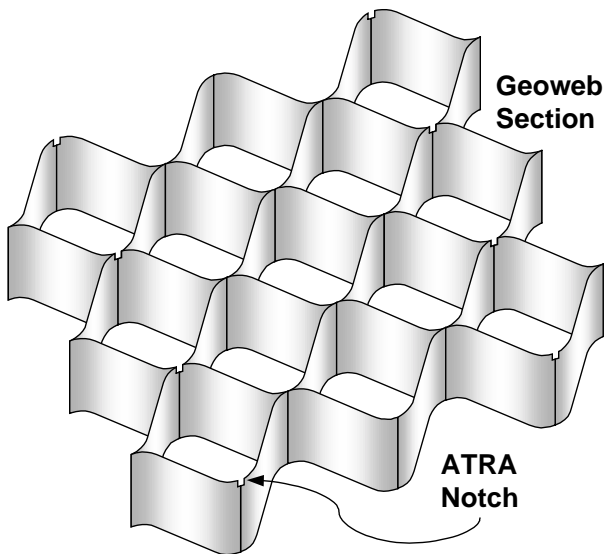


Figure 5 Geoweb Section with ATRA Notch

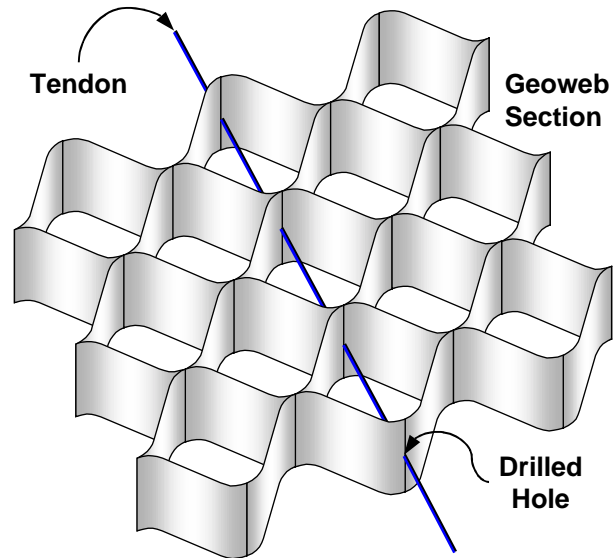


Figure 6 Drilled Geoweb Section with Tendon

Specifier Choice for Special Features

The specifier shall state which of the special Geoweb section features are required for the application. Refer to *THE GEOWEB SYSTEM TECHNICAL OVERVIEW* documents for recommendations.



GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Tendons

Polyester Tendons – Polyethylene Coated

The polyester tendon shall be manufactured from bright, high-tenacity, industrial-continuous-filament polyester yarn woven into a round braided cord consisting of a parallel filament inner core covered with 32 strands of braided polyester. The overall mass shall be 12 kg/1000 m (8.1 lb/1000 ft). Elongation shall be approximately 10% at 450 kg (1000 lbf) load. The coating over the polyester tendon shall be low-density polyethylene with a thickness of 0.4-0.6 mm (15-25 mils). The tendon reference name, diameter / width and minimum-break-strength shall be per Table 4.

Polyester Tendons – Uncoated

The polyester tendon shall be manufactured from bright, high-tenacity, industrial-continuous-filament polyester yarn woven into a braided strap. Elongation shall be 9-15% at break. The tendon reference name, diameter / width and minimum break-strength shall be per Table 4.

Table 4 Polyester Tendon - Coated and Uncoated

Reference Name	Tendon Diameter / Width		Tendon Minimum Break-strength	
	mm	in	kN	lbf
TPC-71 (coated)	5 dia	0.180 dia	7.12	1600
TP-31 (uncoated)	13	0.500	3.11	700
TP-67 (uncoated)	19	0.750	6.70	1506
TP-93 (uncoated)	19	0.750	9.30	2090

Kevlar® Aramid Tendons

The Kevlar® aramid tendon shall be a woven strap having the reference name, width and minimum break-strength per Table 5.

Table 5 Kevlar® Aramid Tendon

Reference Name	Tendon Diameter / Width		Tendon Minimum Break-strength	
	mm	in	kN	lbf
TK-89	10	0.375	8.90	2000
TPP-133	16	0.625	13.34	3000



GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Polypropylene Tendons

The polypropylene tendon shall be 3-strand twisted rope having the reference name, diameter and minimum break-strength per Table 6.

Table 6 Polypropylene Tendon				
Reference Name	Tendon Diameter / Width		Tendon Minimum Break-strength	
	mm	in	kN	lbf
TPP-44	6 dia	0.25 dia	4.40	990

The ATRA® Clip Restraint Pin

The ATRA® Clip shall be used as a load transfer pin within the tendoned Geoweb® system. The ATRA® Clip Restraint Pin shall transfer load from the infilled Geoweb cells to the tendon. The ATRA® Clip shall be molded from high-strength polyethylene.



Figure 7 ATRA® Clip

Specifier Choice for Tendons and Restraint Pins

The specifier shall state which tendon is to be used. Tendon strength must meet design requirements for the application. The specifier shall also state if the ATRA® Clip restraint pin is needed. Refer to *THE GEOWEB SYSTEM TECHNICAL OVERVIEW* documents for recommendations

Geoweb Section Anchoring Components

NOTE: All measurements are subject to manufacturing tolerances unless otherwise stated.

Anchoring Requirements

Geoweb sections, with or without tendons, shall be anchored in accordance with construction drawings. Rows of ATRA™ Anchors or stake anchors shall engage and bear against the cell walls, or engage and hold the integral tendons against the foundation soil. The size, type and distribution of ATRA™ Anchor (stake anchors) shall be in accordance with the construction drawings.



GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

Anchor Systems

ATRA™ GFRP Anchor

The ATRA™ GFRP Anchor shall be a pre-assembled unit consisting of the ATRA® Clip inserted onto the ATRA™ GFRP Stake so that the end of the Stake is flush with or 3 mm (1/8 in) maximum above the top of the ATRA® Clip. Prior to inserting the ATRA® Clip on the end of the stake, the stake end shall be ground or filed so it has a bevel and is free from all burrs.

ATRA™ GFRP Stake

The ATRA™ GFRP Stake shall be composed of glass fiber reinforced polymer with a sand-coating. Glass reinforcement content shall be 75% minimum by weight and shall be continuous longitudinal filament. The use of non-continuous filament is strictly prohibited. Polymer shall be vinyl ester, isophthalic polyester, or other matrix material. The outer surface of the Stake shall be sand coated and deformed by a helical wrap of glass. The ATRA™ GFRP Stake shall have a minimum tensile strength of 655 MPa (95 ksi) per ASTM D638. The Stake shall be non-magnetic, non-conducting and corrosion resistant. The Stake diameter shall be 12-13 mm (1/2 in). The length shall be per construction drawings. Prior to inserting the ATRA® Clip on the end of the stake, the stake end shall be ground or filed so it has a bevel and is free from all burrs.

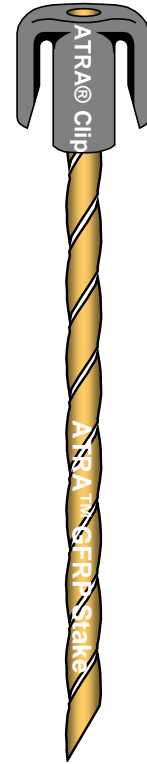


Figure 8
ATRA™ GFRP Anchor

ATRA™ Anchor

The ATRA™ Anchor shall be made by properly inserting the ATRA® Clip onto the ATRA™ Stake so that the end of the Stake is flush with or 3 mm (1/8 in) maximum above the top of the ATRA® Clip. Prior to inserting the ATRA® Clip on the end of the stake, the stake end shall be ground or filed so it has a bevel and is free from all burrs.

Other ATRA™ Stakes

1. The ATRA™ Stake shall consist of straight 12-13 mm (#4) steel reinforcing rod. The Stake length shall be per construction drawings. Prior to inserting the ATRA® Clip on the end of the stake, the stake end shall be ground or filed so it has a bevel and is free from all burrs.
2. The ATRA™ Stake shall consist of straight 12-13 mm (#4) steel reinforcing rod hot dipped galvanized per AASHTO M-218. The Stake length shall be per construction drawings. Prior to inserting the ATRA® Clip on the end of the stake, the stake end shall be ground or filed so it has a bevel and is free from all burrs.
3. The ATRA™ Stake shall consist of straight 12-13 mm (½ in) _____ (state metal type) rod. The Stake length shall be per construction drawings. Prior to inserting the ATRA® Clip on the end of the stake, the stake end shall be ground or filed so it has a bevel and is free from all burrs.



GEOWEB® CELLULAR CONFINEMENT SYSTEM MATERIAL SPECIFICATION

GFRP Stakes

The GFRP Stake shall be composed of glass fiber reinforced polymer with a sand-coating. Glass reinforcement content shall be 75% minimum by weight and shall be continuous longitudinal filament. The use of non-continuous filament is strictly prohibited. Polymer shall be vinyl ester, isophthalic polyester, or other matrix material. The outer surface of the stake shall be sand coated and deformed by a helical wrap of glass. The stake shall have a minimum tensile strength of 655 MPa (95 ksi) per ASTM D638. The stake shall be non-magnetic, non-conducting and corrosion resistant. The stake diameter and length shall be per construction drawings.

Steel J-pin Stakes

Steel J-pin stakes shall be fabricated from mild steel or reinforcing steel rod. Each stake shall have a minimum-radius, 180-degree return at one end. Rod diameter shall be 8 mm (0.3125 in), 10 mm (0.375 in), 12 mm (0.50 in), 16 mm (0.625 in) or 20 mm (0.75 in). Stake length shall be per the construction drawings. When specified, galvanizing shall be per AASHTO M-218.

Straight Steel Stakes

Straight steel stakes shall be fabricated from mild steel or reinforcing steel rod. Rod diameter shall be 8 mm (0.3125 in), 10 mm (0.375 in), 12 mm (0.50 in), 16 mm (0.625 in) or 20 mm (0.75 in). Stake length shall be per the construction drawings. When specified, galvanizing shall be per AASHTO M-218.

Straight Metal Stakes

Straight metal shall be fabricated from _____ (state metal type) rod. Rod diameter shall be 8 mm (0.3125 in), 10 mm (0.375 in), 12 mm (0.50 in), 16 mm (0.625 in) or 20 mm (0.75 in). Stake length shall be per the construction drawings.

Wood Stakes

Wood stakes shall be made from _____ (state wood type) and shall be free from knots that effect the strength of the stake. The stakes shall have a cross section of _____ by _____ and be _____ long.

Specifier Choice for Anchoring Systems

The specifier shall state which of the anchoring methods are required for the application and choose from the stated options. Refer to *THE GEOWEB SLOPE PROTECTION SYSTEM* and/or *CHANNEL PROTECTION SYSTEM TECHNICAL OVERVIEW* for recommendations. Note, the glass fiber reinforced polymer ATRA™ GFRP Stake is available from Presto separately or with the ATRA® Clip already attached to form the ATRA™ GFRP Anchor. Other ATRA™ Stakes are not available from Presto.