

SPECIFICATIONS

CEMSEAL VERSIWEB

○ SLOPE PROTECTION

1 GENERAL

All work in this Section shall comply with the requirements of the Contract Documents. Supply and install slope protection and earth retention as shown on the drawings or specified herein.

2 MATERIALS

The slope protection and earth retention shall be CEMSEAL VERSIWEB expandable cellular soil confinement system supplied by Cemseal Industries Sdn Bhd (Tel: +607-558 3320, Fax: +607-556 9127, E-mail: info@cemseal.com.my) or approved equivalent.

GENERIC SPECIFICATION

The slope protection and earth retention shall be expandable cellular soil confinement ('geocells') system. The geocells shall be regularly spaced and uniform in shape and size to ensure even distribution of loads. The joints shall be spot-welded with at least 3 welds per 25 mm uniformly spaced across the depth of each strip;

The geocells shall be manufactured from solid plastic strips with regular perforations or holes for drainage purposes.

Typical properties of the geocells:

PROPERTY		VALUE
Material		HDPE
Section size (unexpanded)		3350 (L) x 125 (W) mm
Section size (expanded)		6100 (L) x 2440 (W) mm
Nominal cell size (expanded)		244 x 203 mm
Thickness of sheet		1.2 mm ± 5%
Weight per m ²	50 mm	0.83 kg
	75 mm	1.24 kg
	100 mm	1.66 kg
	150 mm	2.48 kg
	200 mm	3.32 kg
Tensile strength	(long.)	18.4 MPa
	(trans.)	19.5 MPa
Long Term Seam Strength		>30 days
Environment stress crack resistance (ASTM D1693)		>3000 hrs
Cell joint tensile strength		approx. 150 kgf (100 mm depth)

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3.1 The proprietary materials specified herein shall be provided / installed in accordance to the project requirement as approved by the Superintending Officer.

3.2 Proprietary materials supplied shall be identified clearly with the product name and description. Packaged materials shall be stored in manufacturer's wrappings and containers with the manufacturer's labels and seals intact.

3.3 Prior to installation, the Contractor shall submit Method Statements and/or Shop Drawings for the installation of the geocells. The latter shall be on at least A3 size paper or larger and in a CAD-recognisable format.

3.4 Slope preparation

- (a) Remove debris and vegetation cover from the embankment area.
- (b) Complete other earthworks, excavation and / or fills, according to the plans.
- (c) Where necessary, remove unacceptable in-situ soils that are for the slope protection system and replace with suitable materials.
- (d) Excavate the specified toe-in trenches or berms where specified along the crest and at the bottom of the slope or secure in position accordingly.

3.3 Slope or embankment protections against ground water

When excessive ground water or loose soil is present, a suitable non-woven geotextile as recommended by the supplier of the geocells system shall be installed over the slope and secured in position accordingly.

3.4 Installation of slope protection sections

- (a) Drive straight stakes or J-pegs part way into the ground along the toe-in trench or along the top of the area to be protected at maximum 1500 mm c/c to mark out the area to be covered.
- (b) Expand the geocell section and place each expanded end cell of the section over its corresponding pre-installed stake or J-pegs.
- (c) Drive the stakes or J-pegs flush with the top of the geocells. If J-pegs are used, ensure that the bent hooks are anchored over the cell walls.
- (d) Expand the geocell sections down the slopes to the full expanded length of the section.

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- (e) Hold the fully expanded sections open using one of the following methods:
 - (i) Straight stakes or steel J-pegs
 - (ii) In-fill several of the peripheral cells
 - (iii) Attached U-clips to adjoining sections

3.5 Placing and connecting sections

- (a) Check each geocell section to ensure that it is fully expanded. Full expansion of section will result in a more effective slope protection.
- (b) Correctly align and interleaf edges of adjoining sections and ensure that the upper surface of adjoining sections are flushed.
- (c) Fasten geocell sections together with industrial grade staples at a maximum spacing of 25 mm or as recommended by the manufacturer.
- (d) Drive additional straight stakes or J-pegs at the specified spacing within the cells of the expanded geocell sections.
- (e) If the slope is longer than one expanded section, drive another row of stakes at the bottom end of the preceding expanded section and continue with the new geocell sections and fasten the new and preceding section with staples as indicated above.

3.6 Placement of in-fill materials in geocell sections

- (a) After geocell sections have been secured to the slope, begin in-filling with the specified materials.
- (b) Place in-fill materials in expanded cells with suitable material handling equipment.
- (c) Limit drop height of in-fill material to 1000 mm maximum.
- (d) Avoid displacement of geocell sections and compact in-fill material as follows:
 - (i) Screen top soil and overfill geocells 25 mm to 50 mm. Lightly tamp to leave soil flush with the top edge of the cells. Apply any specified surface treatment.
 - (ii) Turfing may then be laid on top of the lightly compacted in-fill.

PROJECT REFERENCES

Completed Projects

CHANGI AIR BASE *SD Architects*

CHESTNUT CRESCENT NO. 17 *Holin Construction*

HDB MARINE CRESCENT MUP 16 *Housing Development Board*

HDB PUNGGOL EAST C11 & C12 *Housing Development Board*

LEEDON ROAD NO. 47 *Kevin Construction*

MacRITCHIE NATURE RESERVE *National Parks*

NANYANG TECHNOLOGICAL UNIVERSITY *CPG Consultants*

SHAN ROAD *Land Transport Authorities*

THOMSON 800 CONDOMINIUM *ADDP Architects*

KHEAM HOCK ROAD NO. 20 *Aamer Tahar Design Studio*

TREVOSE CRESENT *William Lim Associates*

CHANGI BEACH CLUB *AJ Engineers*

SENGKANG N4 C6 *Housing Development Board*

CLUNY ROAD *Green-Werkz Landscape Services Pte Ltd*

LIAN HUA PRIMARY SCHOOL *CPG Consultants*

GURKHAR CAMP PHASE 3 *CPG Consultants*

GURKHAR CAMP PHASE 3A *CPG Consultants*

JALAN PEMIMPIN CONDOMINIUM *T.Y.Lin South East Asia Pte Ltd*

18 LEEDON HEIGHTS *WTS Consulting Engineers*

SENGKANG METHODIST CHURCH *Albert Loh Consultants*

LABRADOR PARK CAR PARK A *National Parks*

NPCC CAMPSITE AT PULAU UBIN *CPG Consultants*

ORCHID APARTMENT *Mega Consult*

NTU RESEARCH TECHNO PLAZA *CPG Consultants*

CAPRICORN DRIVE NO. 24 *Uni-Associates Consultants*

MOULMEIN RISE NO.1 *Woha Architects*

ORIX CAR RENTAL *Design Connections International*

NANYANG PRIMARY SCHOOL *Ong & Ong Architects*

UMCI *Jurong Consultants*

ANN SIANG HILL PARK *National Parks*

RIDOUT ROAD NO.47 *AT-II Architects*

PROJECT REFERENCES

Completed Projects

ALEXANDRA DISTRI PARK *Design International*
CHANGI FERRY TERMINAL *Urban Redevelopment Authority*
SERENITY PARK CONDOMINIUM *Colliers International Asset Management Pte Ltd*
LABRADOR PARK JETTY Phase 1 *National Parks*
LEVELZ CONDOMINIUM *LandArt*
NTU SCHOOL OF BIOLOGICAL SCIENCE *CPG Consultants*
MANDAI CREMATORIUM AND COLUMBARIUM *CPG Consultants*
NUS YUSOFF ISHAK BUILDING *CPG Consultants*
RED CROSS CAMPSITE *CPG Consultants*
SIMEI ITE CAMPUS *RSP Architects Planners & Engineers Pte Ltd*
RIDGWOOD CONDOMINIUM *Ridgewood Condominium MSCT No.533*
JURONG COUNTRY CLUB *Jurong Country Club*
CHANCERY HILL WALK CLUSTER HOUSING *TAA Architects*
LABRADOR PARK JETTY Phase 2 *National Parks*
KENT RIDGE PARK *National Parks*
31 NASSIM ROAD *RichardHo Architects*
39 GILSTEAD ROAD *LK Ang*
CHESTNUT DRIVE SECONDARY SCHOOL *CPG Consultants*
GIRLS' COMPLEX *CPG Consultants*
HDB TOA PAYOH RC30 *Surbana*
BEDOK TOWN PRIMARY SCHOOL *CPG Consultants*
7E BALMORAL ROAD RESIDENTIAL *Tham & Wong*
32 BIN TONG PARK RESIDENTIAL *TAA Architects Pte Ltd*
ST. JOHN'S ST. MARGARET'S CHURCH *Architects 61*
SAFRA – MT. FABER *Martin Lee Designs*
NUS KING GEORGE'S HALL *CPG Consultants*
VIVO CITY *DP Architects*
BAYSHORE PARK CONDOMINIUM
NUS KING EDWARD HALL *AGS Consult*
THE PEARL CONDOMINIUM *Design Link Architects*
JURONG HILL *Jurong Consultants*
LAW ENFORCEMENT ACADEMY TRAINING VILLAGE *CPG Consultants*

PROJECT REFERENCES

Completed Projects

HOTEL @ IMBIAH WALK, SENTOSA *Tan + Tsakonas Architects*

NTU TEACHING FACILITIES – SCHOOL OF BIOLOGICAL SCIENCE *CPG Consultants*

MOUNT FABER II SERVICE RESERVOIR *Public Utilities Board*

CELEBRITIES RESORT CLUB *Owner*

TAMPINES DORMITORY *Jurong Consultants*

8 CALDECOTT CLOSE *Owner*

FORT SILOSO *Sentosa Developments Corporation*

SENTOSA GOLF CLUB *Sentosa Developments Corporation*

JURONG TOWN HALL *Jurong Consultants*

ALEXANDRA LINK BRIDGE *Look Architects*

SEMBAWANG AVENUE *Singapore Land Authority*

SEMBAWANG HILL *Singapore Land Authority*

CAPELLA *Belt Collins International*

HDB TELOK BLANGAH ST 32 *Surbana Consultants*

PRINCE GEORGE'S PARK *CPG Consultants*

HDB BISHAN ST 21 *Surbana Consultants*

SWETTENHAM GREEN RESIDENCE *Eco-id*

HDB BISHAN ST 21 *Surbana Consultants*

59 PORTSDOWN ROAD *Jurong Counsultation*

HOTEL RE! *LT & T Architects*