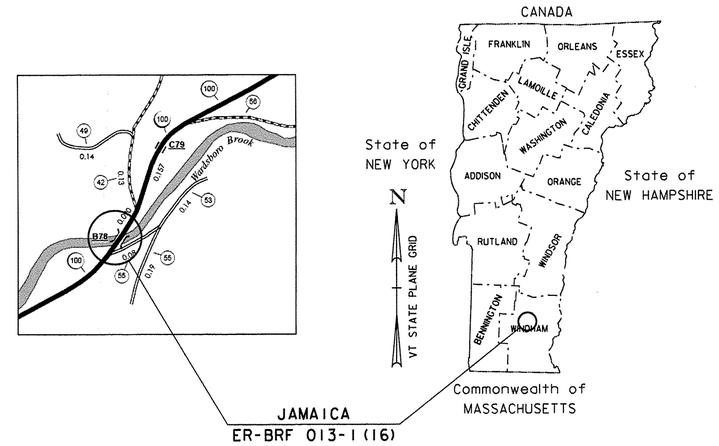
STATE OF VERMONT
AGENCY OF TRANSPORTATION



PROPOSED IMPROVEMENT
BRIDGE PROJECT
TOWN OF JAMAICA
COUNTY OF WINDHAM

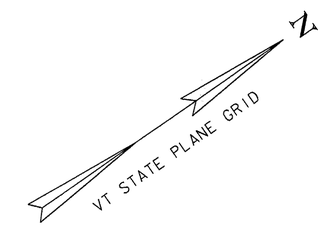
Vermont Agency of Transportation
RECEIVED
Jamaica ER BRF013-1(16) Retaining Wall Submittal 5-2-2013.pdf
CK'D BY CB/JG/GL OK'D BY JTS
May 4, 2013
RESUBMIT NO Approved
BY KH DATE 05/15/13

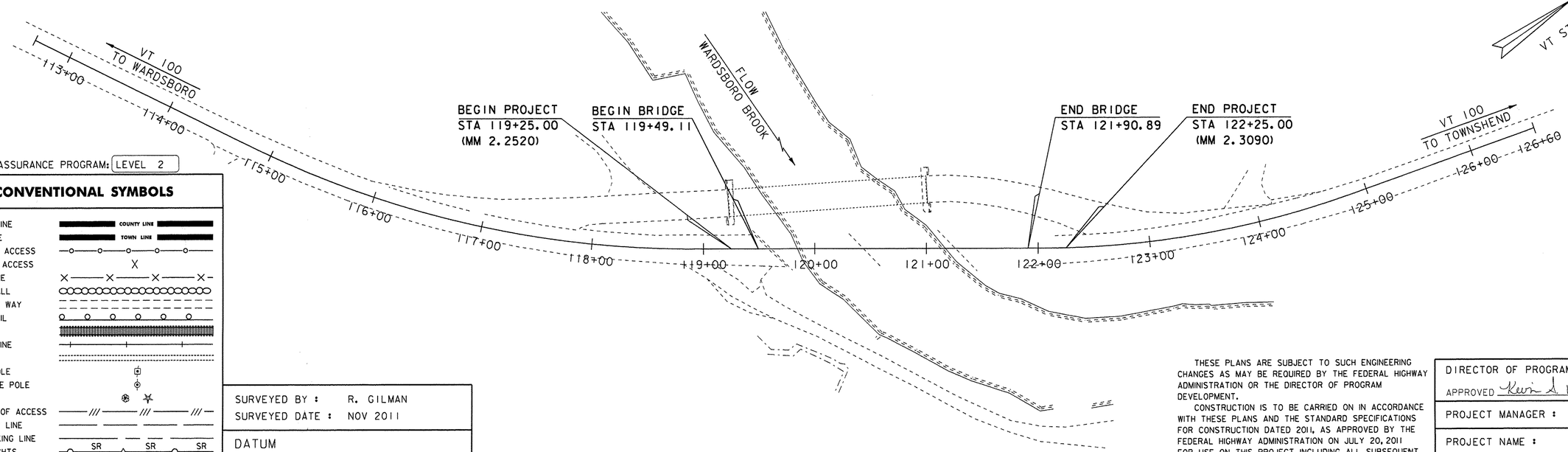
ROUTE NO : VT 100 (MINOR ARTERIAL) BRIDGE NO : 78

PROJECT LOCATION : LOCATED APPROXIMATELY 1.5 MILES SOUTH OF THE JUNCTION OF VT ROUTE 100 AND VT ROUTE 30.

PROJECT DESCRIPTION : REPLACE EXISTING BRIDGE WITH RELATED ROADWAY APPROACH AND CHANNEL WORK.

LENGTH OF STRUCTURE :	241.78 FEET.
LENGTH OF ROADWAY :	58.22 FEET.
LENGTH OF PROJECT :	300.00 FEET.





QUALITY ASSURANCE PROGRAM: LEVEL 2

CONVENTIONAL SYMBOLS

COUNTY LINE
TOWN LINE
LIMITS OF ACCESS
POINT OF ACCESS
FENCE LINE
STONE WALL
TRAVELED WAY
GUARD RAIL
RAILROAD
SURVEY LINE
CULVERT
POWER POLE
TELEPHONE POLE
TREES
CONTROL OF ACCESS
PROPERTY LINE
R.O.W. TAKING LINE
SLOPE RIGHTS
TOP OF CUT
TOE OF SLOPE

SURVEYED BY : R. GILMAN
SURVEYED DATE : NOV 2011

DATUM
VERTICAL NAVD 88
HORIZONTAL NAD 83 (92)

SCALE 1" = 50'-0"
50 0 50

THESE PLANS ARE SUBJECT TO SUCH ENGINEERING CHANGES AS MAY BE REQUIRED BY THE FEDERAL HIGHWAY ADMINISTRATION OR THE DIRECTOR OF PROGRAM DEVELOPMENT.

CONSTRUCTION IS TO BE CARRIED ON IN ACCORDANCE WITH THESE PLANS AND THE STANDARD SPECIFICATIONS FOR CONSTRUCTION DATED 2011, AS APPROVED BY THE FEDERAL HIGHWAY ADMINISTRATION ON JULY 20, 2011 FOR USE ON THIS PROJECT, INCLUDING ALL SUBSEQUENT REVISIONS AND SUCH REVISED SPECIFICATIONS AND SPECIAL PROVISIONS AS ARE INCORPORATED IN THESE PLANS.

DIRECTOR OF PROGRAM DEVELOPMENT
APPROVED Kevin S. Marchi DATE 10/12/12
PROJECT MANAGER : KRISTIN HIGGINS
PROJECT NAME : JAMAICA
PROJECT NUMBER : ER-BRF 013-1 (16)
SHEET 1 OF 85 SHEETS

R&M Engineering Consultants
P.O. Box 428
Gilmanton, New Hampshire 03273
603-393-9842/603-556-7369 (Fax)

FIELD REPORT

To:	Tim Dudley	**From:**	Richard Bushnell, P.E.
Company:	SD Ireland Companies	**Pages:**	5
Address:	P.O. Box 2286 South Burlington, Vermont	**Date:**	5.2.2013
Re:	Jamaica - VT Retaining Wall Project No. 13-118	**CC:**	

☐ Urgent ☒ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

Comments:

R&M Engineering has reviewed the submittal review and performed the following:

1. Calculations were updated to reflect the 34 deg friction angle and 140 pcf unit weight for the retained soil, as well as the live load surcharge increased to 280 psf. Attached are the revised calculation sheets.
2. With regards to the question regarding the Factor of Safety for sliding noted on Section 3. The Factor of Safety is calculated in two separate locations – between the Base Block and the Leveling Pad and between the Leveling Pad and the Foundation Soil. The program then reports the lowest of the two Factor of Safety on the output sheet.
3. The plan has been revised as per the comments.

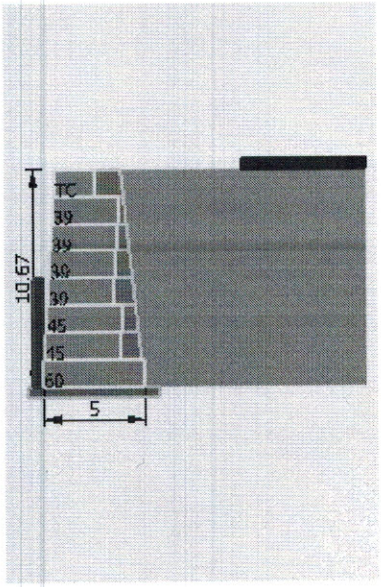
Should you have any question or need further information do not hesitate to contact my office.

ReCon Walls

ReCon Retaining Walls, Inc version 2.1

Project: Jamaica - ER-BRF 013-1(16)
Location: Jamaica, Vermont
Designer: R&M Engineering Consultants
Date: 5/2/2013

Section: Section 1
Design Method: AASHTO_LRFD
Seismic Acc: 0.120



SOIL PARAMETERS	Phi	coh	Gamma
Retained Soil:	34 deg	0 psf	140 pcf
Foundation Soil:	32 deg	0 psf	125 pcf

Leveling Pad: Crushed Stone

GEOMETRY

Design Height:	10.67 ft	Live Load:	280 psf
Wall Batter/Tilt:	3.58/ 0.00 deg	Live Load Offset:	6.00 ft
Embedment:	5.33 ft	Live Load Width:	24 ft
Leveling Pad Depth:	0.50 ft	Dead Load:	0 psf
Slope Angle:	0 deg	Dead Load Offset:	0 ft
Slope Length:	0 ft	Dead Load Width:	0 ft
Slope Toe Offset:	0 ft	Leveling Pad Width:	6.00 ft

LOAD FACTORS

Load Case:	Str max(d)	Str min(r)	Seis max(sd)	Seis min(sr)	Service(serv)
Dead Load (DC)	1.25	0.90	1.25	0.90	1.00
Dead Load Driving (EH)	1.50	0.90	1.50	0.90	1.00
Vertical Earth load (EV)	1.35	1.00	1.35	1.00	1.00
Live Load (LL, PL, LS)	1.75	0.00	0.50	0.00	1.00

RESISTANCE FACTORS

Resistance Case:	Reduction Factor
Bearing Resistance(RFbr)	0.45
Sliding Concrete to Stone(RFsl_c)	0.90
Sliding Stone to Soil(RFsl_s)	0.90

RESULTS (Static / Seismic)

CDR Sliding:	1.35 (fnd) / 1.13	CDR Bearing:	3.80 / 3.80
CDR Eccentricity:	L/ 4.34 / L/ 5.60	Bearing	2815.72 / 188.07

Name	Elev.	FSsl	L/e	siesFSsl	Seis L/e
TC	9.33	146.94	78.98	81.20	131.18
39	8.00	39.29	39.51	23.17	37.22
39	6.67	18.23	15.41	11.99	14.94
39	5.33	10.62	8.12	7.43	7.97
39	4.00	7.02	4.98	5.10	4.92
45	2.67	4.91	6.76	3.69	8.02
45	1.33	3.65	4.26	2.90	5.16
60	0.00	1.38	4.34	1.13	5.60

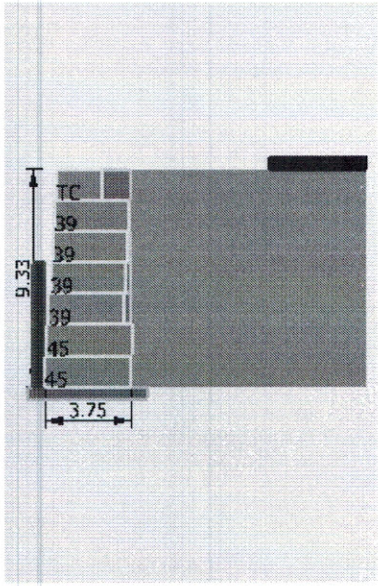
Note: Calculations are for Preliminary use only and should not be used for construction without the review of a qualified professional.

ReCon Walls

ReCon Retaining Walls, Inc version 2.1

Project: Jamaica - ER-BRF 013-1(16)
Location: Jamaica, Vermont
Designer: R&M Engineering Consultants
Date: 5/2/2013

Section: Section 2
Design Method: AASHTO_LRFD
Seismic Acc: 0.120



SOIL PARAMETERS	Phi	coh	Gamma
Retained Soil:	34 deg	0 psf	140 pcf
Foundation Soil:	32 deg	0 psf	125 pcf

Leveling Pad: Crushed Stone

GEOMETRY

Design Height:	9.33 ft	Live Load:	280 psf
Wall Batter/Tilt:	3.58/ 0.00 deg	Live Load Offset:	6.00 ft
Embedment:	5.33 ft	Live Load Width:	24 ft
Leveling Pad Depth:	0.50 ft	Dead Load:	0 psf
Slope Angle:	0 deg	Dead Load Offset:	0 ft
Slope Length:	0 ft	Dead Load Width:	0 ft
Slope Toe Offset:	0 ft	Leveling Pad Width:	4.75 ft

LOAD FACTORS

Load Case:	Str max(d)	Str min(r)	Seis max(sd)	Seis min(sr)	Service(serv)
Dead Load (DC)	1.25	0.90	1.25	0.90	1.00
Dead Load Driving (EH)	1.50	0.90	1.50	0.90	1.00
Vertical Earth load (EV)	1.35	1.00	1.35	1.00	1.00
Live Load (LL, PL, LS)	1.75	0.00	0.50	0.00	1.00

RESISTANCE FACTORS

Resistance Case:	Reduction Factor
Bearing Resistance(RFbr)	0.45
Sliding Concrete to Stone(RFsl_c)	0.90
Sliding Stone to Soil(RFsl_s)	0.90

RESULTS (Static / Seismic)

CDR Sliding:	1.41 (fnd) / 1.11	CDR Bearing:	4.25 / 4.25
CDR Eccentricity:	L/ 4.27 / L/ 5.18	Bearing	2381.45 / 157.00

Name	Elev.	FSsl	L/e	siesFSsl	Seis L/e
TC	8.00	148.42	80.61	81.72	134.90
39	6.67	39.49	39.46	23.26	37.18
39	5.33	18.29	15.46	12.03	14.98
39	4.00	10.65	8.15	7.44	7.99
39	2.67	7.04	4.99	5.11	4.93
45	1.33	4.92	6.77	3.70	8.04
45	0.00	1.44	4.27	1.11	5.18

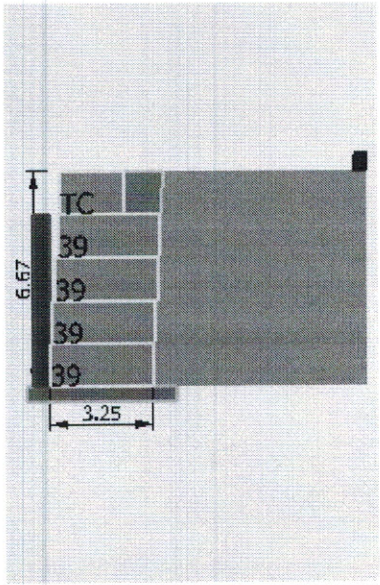
Note: Calculations are for Preliminary use only and should not be used for construction without the review of a qualified professional.

ReCon Walls

ReCon Retaining Walls, Inc version 2.1

Project: Jamaica - ER-BRF 013-1(16)
Location: Jamaica, Vermont
Designer: R&M Engineering Consultants
Date: 5/2/2013

Section: Section 3
Design Method: AASHTO_LRFD
Seismic Acc: 0.120



SOIL PARAMETERS	Phi	coh	Gamma
Retained Soil:	34 deg	0 psf	140 pcf
Foundation Soil:	32 deg	0 psf	125 pcf

Leveling Pad: Crushed Stone

GEOMETRY

Design Height:	6.67 ft	Live Load:	280 psf
Wall Batter/Tilt:	3.58/ 0.00 deg	Live Load Offset:	6.00 ft
Embedment:	5.33 ft	Live Load Width:	24 ft
Leveling Pad Depth:	0.50 ft	Dead Load:	0 psf
Slope Angle:	0 deg	Dead Load Offset:	0 ft
Slope Length:	0 ft	Dead Load Width:	0 ft
Slope Toe Offset:	0 ft	Leveling Pad Width:	4.25 ft

LOAD FACTORS

Load Case:	Str max(d)	Str min(r)	Seis max(sd)	Seis min(sr)	Service(serv)
Dead Load (DC)	1.25	0.90	1.25	0.90	1.00
Dead Load Driving (EH)	1.50	0.90	1.50	0.90	1.00
Vertical Earth load (EV)	1.35	1.00	1.35	1.00	1.00
Live Load (LL, PL, LS)	1.75	0.00	0.50	0.00	1.00

RESISTANCE FACTORS

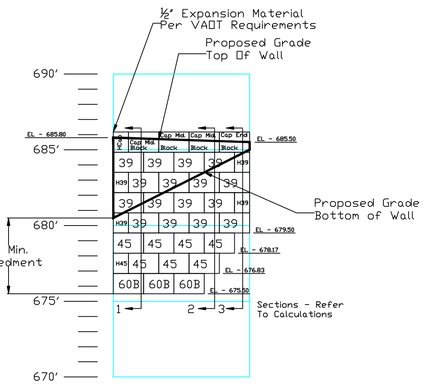
Resistance Case:	Reduction Factor
Bearing Resistance(RFbr)	0.45
Sliding Concrete to Stone(RFsl_c)	0.90
Sliding Stone to Soil(RFsl_s)	0.90

RESULTS (Static / Seismic)

CDR Sliding:	1.64 (lvlpd) / 1.19	CDR Bearing:	7.21 / 7.21
CDR Eccentricity:	L/ 4.98 / L/ 4.92	Bearing	1396.71 / 125.71

Name	Elev.	FSsl	L/e	siesFSsl	Seis L/e
TC	5.33	146.94	78.98	81.20	131.18
39	4.00	39.29	39.51	23.17	37.22
39	2.67	18.23	15.41	11.99	14.94
39	1.33	10.62	8.12	7.43	7.97
39	0.00	1.64	4.98	1.19	4.92

Note: Calculations are for Preliminary use only and should not be used for construction without the review of a qualified professional.
ReCon Retaining Walls, Inc



RECON BLOCK RETAINING WALL
ELEVATION VIEW
FACING WALL
Scale: H - 1"=10' V - 1"=5'

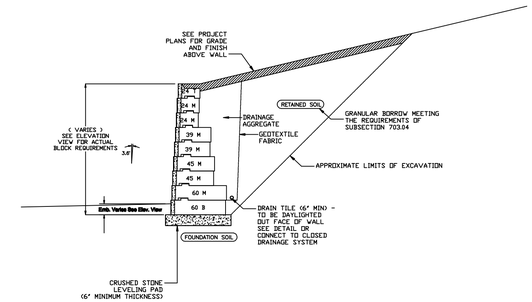
Quantities

½ FH CAP BLOCK - 1 blks (5.33 sf)
FH CAP BLOCK - 3 blks (31.98 sf)
FH CAP END BLOCK - 1 blk (13.33 sf)
39 FULL BLOCK - 16 blks (85.28 sf)
H39 FULL BLOCK - 4 blk (10.66 sf)
45 FULL BLOCK - 7 blks (37.31 sf)
H45 FULL BLOCK - 1 blk (2.67 sf)
60 BASE BLOCK - 3 blk (15.99 sf)

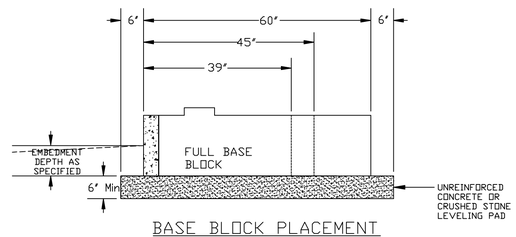
TOTAL SF OF WALL FACE - 202.55 sq ft

LEGEND

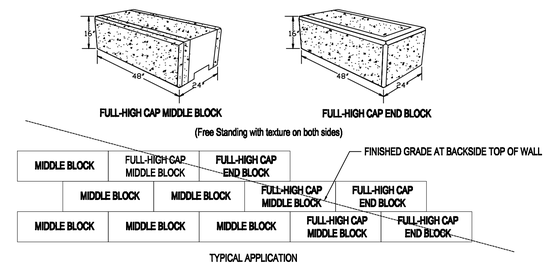
24	SIZE & TYPE OF BLOCK - I.E. 24 FULL BLOCK
24B	SIZE & TYPE OF BLOCK - I.E. 24 BASE BLOCK



TYPICAL GRAVITY WALL SECTION
NTS



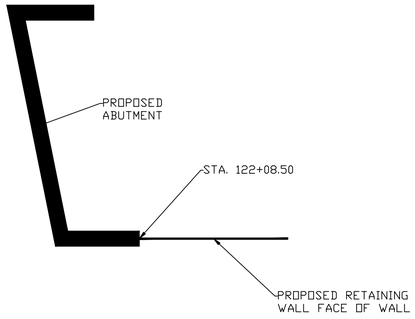
BASE BLOCK PLACEMENT



TYPICAL APPLICATION

NOTE: When a retaining wall is constructed that is supporting a road or sidewalk and the grade of the road or sidewalk is not level, it will be helpful to use a Full-High Cap Block at the end of each course of retaining wall block. This will provide texture on the back side of the wall (facing the road or sidewalk) until the grade is sufficient to cover the untextured back of a typical retaining wall block.

NOTES:
1. LEVELING PAD SHOULD BE AS SPECIFIED BY THE DESIGN ENGINEER IN THE PROJECT PLAN SET.
2. THE WIDTH OF THE LEVELING PAD MUST EXTEND 6" (MINIMUM) IN FRONT AND 6" (MIN) IN BACK OF THE BASE BLOCK. AS A RESULT, THE TYPICAL WIDTH OF LEVELING PAD WOULD BE:
   39" DEEP BASE BLOCK..LEVELING PAD WIDTH IS 51"
   45" DEEP BASE BLOCK..LEVELING PAD WIDTH IS 57"
   60" DEEP BASE BLOCK..LEVELING PAD WIDTH IS 72"
3. **SET THE BASE BLOCK AND CHECK FOR LEVEL FROM FRONT TO BACK.**
4. COMPACTION TO THE SPECIFIED EMBEDMENT DEPTH SHALL BE DONE IN FRONT OF THE BASE BLOCK **BEFORE** COMPACTION IS DONE BEHIND THE BASE BLOCK. THIS REDUCES THE CHANCE THAT COMPACTION BEHIND THE BASE BLOCK WILL ROLL THE BASE BLOCK FORWARD.
5. SEE BLOCK SPECIFICATION & INSTALLATION INSTRUCTIONS FOR MORE DETAILS.



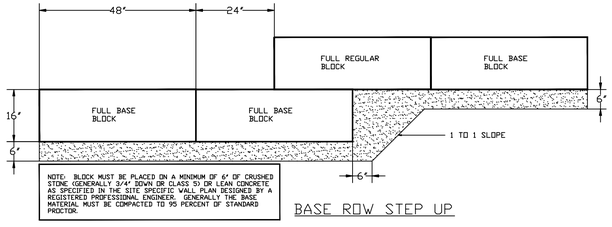
VICINITY SKETCH
(REFER TO PROJECT PLANS FOR SCALED LOCATIONS)
NOT TO SCALE

Vermont Agency of Transportation
RECEIVED
Jamaica ER BRF013-1(16) Retaining Wall Submittal 5-2-2013.pdf

CK'D BY CB/JG/GL OK'D BY JTS

May 4, 2013

RESUBMIT NO Approved
BY KH DATE 05/15/13



BASE ROW STEP UP

NOTES:

1. WALL TO BE CONSTRUCTED TO LINE AND GRADE ON THE CIVIL ENGINEERING SITE PLAN PREPARED BY VHB, INC. DATED 12 OCTOBER 2012.

2. EXCAVATION LIMITS FOR INSTALLATION OF THE RETAINING WALL SHALL CONFORM TO OSHA STANDARDS. CONTRACTOR IS RESPONSIBLE FOR CLASSIFICATION OF SOIL IN ACCORDANCE WITH OSHA STANDARDS AND MAINTAINING APPROPRIATE SLOPE LAYBACK REQUIREMENTS. ADDITIONALLY, CONTRACTOR IS RESPONSIBLE FOR VERIFICATION OF PROPERTY LINE BOUNDARIES AND OBTAINING APPROPRIATE PERMITS OR EASEMENTS AS NECESSARY TO COMPLETE INSTALLATION OF THE RETAINING WALL. CONTRACTOR IS RESPONSIBLE FOR MAINTAINING THE BEARING AREA FOR THE EXISTING STRUCTURE AND PROVIDING ANY SUPPORT REQUIRED. CONTRACTOR IS ALSO RESPONSIBLE FOR MAINTAINING THE INTEGRITY OF THE EXISTING CMU WALL. CONTRACTOR TO TAKE CARE IN NOT DISTURBING WALL DURING INSTALLATION.

3. BACKFILL BEHIND WALL TO BE FREE-DRAINING BACKFILL SHALL BE WELL-GRADED, COMPACTIBLE AGGREGATE MEETING AND PLACED IN ACCORDANCE WITH VAOT SPECIFICATIONS.

4. UNIT DRAINAGE FILL TO CONSIST OF DRAINAGE AGGREGATE MEETING THE REQUIREMENTS OF SUBSECTION 704.16, PLACE GEOTEXTILE FABRIC, MEETING THE REQUIREMENTS OF SUBSECTINO 720 BETWEEN THE DRAINAGE AGGREGATE AND GRANULAR BACKFILL.

5. SUBGRADE UNDERLYING LEVELING PAD SHALL CONSIST OF FIRM, DRY, UNDISTURBED NATURAL GLACIAL TILL SOILS OR FREE-DRAINING FILL COMPACTED TO 95% OF MAXIMUM DRY DENSITY DETERMINED IN ACCORDANCE WITH STANDARD PROCTOR TEST (ASTM D-698). SUBGRADE TO BE CAPABLE OF 3,000 PSF BEARING CAPACITY TO BE VERIFIED BY QUALIFIED ENGINEER IN FIELD.

6. RETAINING WALL SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

7. FOUNDATION DRAIN TO DAYLIGHT AT LOW-POINT OF WALL OR CONNECT TO A CLOSED DRAINAGE SYSTEM. WALL BLOCK TO BE CUT OR CORED IN FIELD TO ALLOW FOR DRAIN PIPE TO EXTEND THROUGH FACE OF WALL. SEE DETAIL PROVIDED HEREON.

8. FENCE OR GUARDRAIL, IS TO BE INSTALLED WHERE REQUIRED BY CODE OR PROJECT PLANS. REFER TO RECON STANDARD DETAIL FOR INSTALLATION OF APPROPRIATE ITEM AND IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. ACTUAL DESIGN OF FENCE/GUARDRAIL BY OTHERS.

9. IF SITE CONDITIONS ARE DIFFERENT THAN THOSE ASSUMED FOR DESIGN, R&M ENGINEERING CONSULTANTS SHOULD BE NOTIFIED AND THE VALIDITY OF THE DESIGN VERIFIED.

10. CONTRACTOR IS RESPONSIBLE TO MAINTAIN ALL EROSION CONTROL MEASURES REQUIRED BY CODE - R&M IS NOT RESPONSIBLE FOR EROSION CONTROL MEASURES OR APPLICATION OF FINISH SLOPE TREATMENT.

STATE OF VERMONT
RICHARD E. BUSHNELL
No. 7382
CIVIL
LICENSED
PROFESSIONAL ENGINEER

RETAINING WALL CONSTRUCTION PLAN
RECON BLOCK WALL
JAMAICA ER-BRF 013-1(16) SPECIAL
PROVISION RETANING WALL JAMAICA, VT

DATE:	REVISIONS	DATE:	DRAWN BY
5/2/13	PER COMMENTS	3/15/13	R. BUSHNELL, P. E.
		PROJ. NUMBER 13-118	CHECKED BY R. BUSHNELL, P. E.

SHEET 1 OF 1

PREPARED FOR:
SD IRELAND COMPANIES
WILLISTON, VERMONT

PREPARED BY:
R & M ENGINEERING CONSULTANTS
38 EDWARDS DRIVE, GILMANTON IW, NH 03837
TEL: (603) 393-9842 FAX: (603) 556-7369

PCI™ Precast/Prestressed Concrete Institute

Be it known that

S.D. Ireland Concrete Construction Corp.

South Burlington, VT

is a Producer member in good standing

in the

Precast/Prestressed Concrete Institute
entitled to full rights and privileges
set forth in the Bylaws.

Gregory F. Force
Chairman of the Board

Expires: update to reflect 2013 in progress, as a result of 1 May 2013 successful annual review

This certificate has no bearing on plant certification status. To verify that plant is currently PCI certified contact headquarters a

This is to certify that the quality control procedures of

S.D. Ireland

193 Industrial Ave.
Williston, VT 05495

were audited during an on-site plant inspection on 1 May 2013 and have met the

Precast Concrete Requirements

stated in the 9th Edition of the NPCA Quality Control Manual for Precast and Prestressed Concrete Plants

Participation in the NPCA Plant Certification program affirms an ongoing commitment to producing quality precast concrete products to recognized standards of the *American Association of State Highway and Transportation Officials* (AASHTO), the American Concrete Institute (ACI), the ASTM International (ASTM), the American Welding Society (AWS), the Precast Prestressed Concrete Institute (PCI), and the Concrete Reinforcing Steel Institute (CRSI).

This certificate is valid through update to 2013 in progress resulting 1 May 2013 successful audit

Thomas E. Engelman, Chairman of the Board

Ty E. Gable, NPCA President

Phillip B. Cutler, P.E., Director of Technical Services

NPCA
CERTIFIED PLANT

S.D. Ireland
Concrete Construction Corporation
802-863-6222 • Fax: 802-860-1528
www.sdireland.com

CONCRETE MIX DESIGN

5000 psi

SCC

SDI MIX CODE: P50TER

DATE: September 14, 2012 **PLANT:** Burlington, VT

PROJECT: **General DOT Precast - 2012**

FINE AGGREGATE:
ASTM C 33

Source:	Hinesburg Sand & Gravel
Specific Gravity:	2.67 (Abs.: 1.15%)
Fineness Modulus:	2.9

COARSE AGGREGATE:
ASTM C 33

Source:	S.D. Ireland, Brownell Quarry
Specific Gravity:	2.74 (Abs.: 0.37%)
Description	3/4" 100% Crushed Stone (Size #67)

CEMENT: Ternary Blend Cement; Lefarge North America Lakes and Seaway Re St. Constant, Quebec (22% Slag, 5% Silica Fume, 73% Type II Cement) (Sp.Gvty: 2.98)

ADMIXTURES: Water Reducer (HRWR): Glenium 7500; BASF Admixtures
Air Entraining Agent: Darex II AEA; Grace Concrete Chemicals

CONSTITUENTS (LBS. /YD³)

		Abs.Vol.
Coarse Aggregate (SSD)	1700	9.94
Fine Aggregate (SSD)	1096	6.58
Cement	705	3.91
Water	300	4.81
Air Content (Entrained)	6.5%	1.76
Total	3801	27.00ft³

MIX PROPERTIES/ REQUIREMENTS

Water Cement Ratios: 0.41 (0.44)
Entrained Air Content: 5.0 % – 9.0%
Dry Unit Weight: 140.8 ± pcf
Spread: 21" to 27"
Concrete Temperatures: 50 – 85°F

***ADMIXTURE(S) DOSEAGE (OZ. /YD³)**

Glenium 7500	(HRWR)	46 - 53
Darex II AEA		2.8

TYPICAL STRENGTH GAIN

18-HOURS	1980 psi
3-DAYS	3760 psi
7-DAYS	4790 psi
28-DAYS	6020 psi

*Admixture dosage rates are subject to change.

Cement Mill Test Report

Month of Issue: August 2012

Plant:	**Montreal East, Quebec**
Product:	**Ternary Blend Cement - IT S(22) P (5), (TERCEM 3000)**
Silo:	**Service Silo**
Manufactured:	**July 2012**

ASTM C 595-11 and AASHTO M 240-09 Standard Requirements

CHEMICAL REQUIREMENTS

	Spec limit	Test Result
Rapid Method, X-Ray *(C 114)*		
SiO2 (%)	---	26.3
Al2O3 (%)	---	5.7
Fe2O3 (%)	---	2.4
CaO (%)	---	53.5
MgO (%)	---	4.7
SO3 (%)*	3.0 max	4.0
Loss on ignition (%)	3.0 max	1.3
Sulfide Sulfur (S) (%)	2.0 max	0.8
Na2Oeq (%) from cement portion	---	0.62
Na2Oeq (%) from cement, SF and slag blend	---	0.85

PHYSICAL REQUIREMENTS

	Spec limit	Test Result
Air content of mortar (%) *(C 185)*	12 max	7
Blaine Fineness (m2/kg) *(C 204)*	---	555
Residue retained on a 45 µm sieve (%) (C430)	---	6.6
Autoclave expansion (%) *(C 151)*	0.80 max	0.00
Compressive strength (PSI) *(C 109)*		
3 days	1890 min	3465
7 days	2900 min	4990
28 days (reflects previous month's data)	3620 min	6610
Time of setting (minutes)		
Vicat Initial *(C 191)*	45 - 420	165
Sulfate Expansion *(C 1038)*	---	0.006
Water Extractable Sulfate *(C 265)***	0.5 g/L max	0.32

* May exceed 4.0% SO3 maximum if the C-265 test result is not greater than 0.5 g/L.

**Current Production run not available - most recent provided.

This product meets the requirements of NYSDOT Item 701-03.

For additional information on this cement test report, please contact our regional technical representative Andrea Boddy at (647) 302-3852.

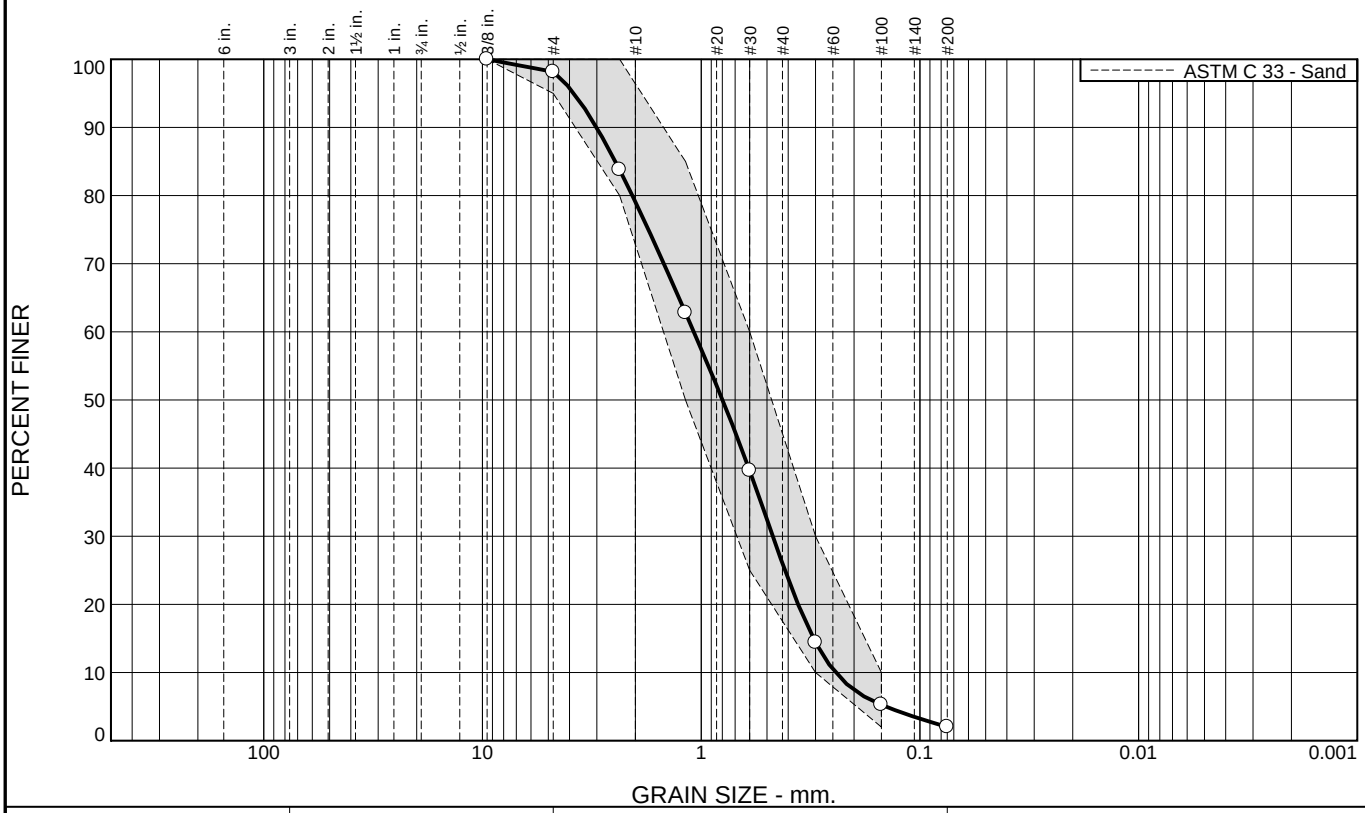
Certified By:

Pascale Poulin

ECAN BU - St-Constant Plant
1 Chemin Lafarge, St-Constant
Phone: 450-632-7750 #218

Pascale Poulin - Quality Coordinator
August 15, 2012

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	2	19	53	24	2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100	100 - 100	
#4	98	95 - 100	
#8	84	80 - 100	
#16	63	50 - 85	
#30	40	25 - 60	
#50	14	10 - 30	
#100	5	2 - 10	
#200	2.0		

* ASTM C 33 - Sand

Material Description

ASTM C-33 Concrete Sand

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS= AASHTO=

Coefficients

D_{85}= 2.4688 D_{60}= 1.0814 D_{50}= 0.7990
D_{30}= 0.4705 D_{15}= 0.3069 D_{10}= 0.2434
C_u= 4.44 C_c= 0.84

Date Tested: 08.30.12 **Tested By:** Nate Parry

Remarks

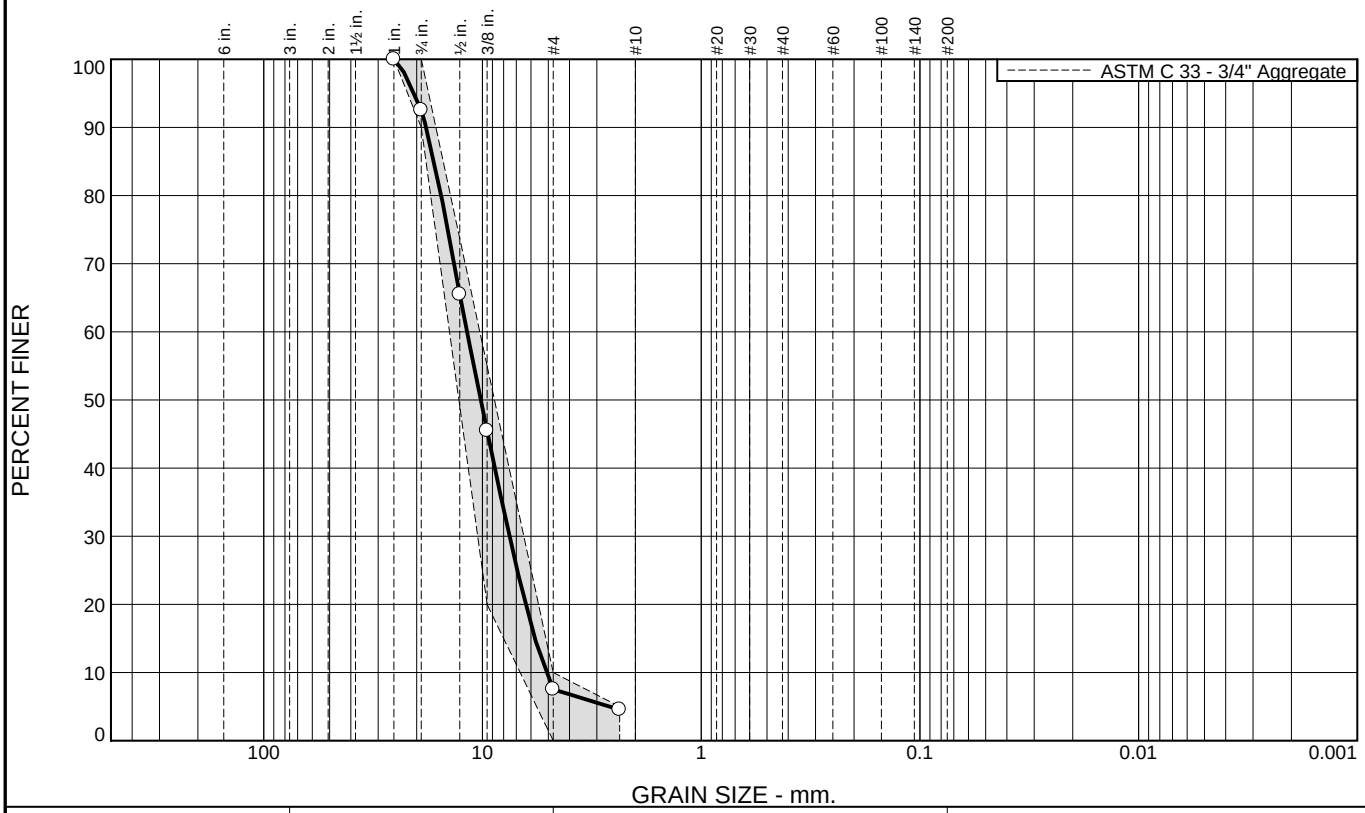
Sampled From Plant Stock Pile
F.M.=2.96

Sample No.: 3 **Source of Sample:** Hinesburg Sand & Gravel; Hinesburg,VT **Date Sampled:** 08.29.12
Location: **Elev./Depth:**
Checked By: Nate Parry **Title:** QC Manager

SD IRELAND CONSTRUCTION CO'S SOUTH BURLINGTON, VT

Client: S.D. Ireland
Project: General Testing
Project No: QC **Figure** 1 of 1

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	7	85	8				

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100	100 - 100	
3/4"	93	90 - 100	
1/2"	65		
3/8"	45	20 - 55	
#4	8	0 - 10	
#8	5	0 - 5	

* ASTM C 33 - 3/4" Aggregate

Material Description

3/4" Ireland Concrete Stone

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS= AASHTO=

Coefficients

D_{85}= 16.6190 D_{60}= 11.7717 D_{50}= 10.1846
D_{30}= 7.5278 D_{15}= 5.7586 D_{10}= 5.1173
C_u= 2.30 C_c= 0.94

Date Tested: 08.30.12 **Tested By:** Nate Parry

Remarks

Sampled from Stockpile at Quarry
F.M.=2.50

Sample No.: 7 **Source of Sample:** Brownell Quarry **Date Sampled:** 08.29.12
Location: **Elev./Depth:**
Checked By: NBP **Title:** QC Manager

SD IRELAND CONSTRUCTION CO'S SOUTH BURLINGTON, VT

Client: S.D. Ireland
Project: General Testing
Project No: QC **Figure** 1 of 1

GRACE

DAREX® II AEA
Air-entraining admixture
ASTM C260

Product Description

Darex® II AEA is an air-entraining admixture which generates a highly stable air void system for increased protection against damage from freezing and thawing, severe weathering, or de-icer chemicals. Darex II AEA is a complex mixture of organic acid salts in an aqueous solution specifically formulated for use as an air-entraining admixture for concrete and is manufactured under rigid control which provides uniform, predictable performance. It is supplied ready-to-use and does not require pre-mixing with water. Darex II AEA is a dark brown liquid. One gallon weighs 8.7 lbs (1.04 kg/L). Darex II AEA complies to ASTM C260 *Standard Specifications for Air-Entraining Admixtures for Concrete.*

Uses

Darex II AEA is used in ready-mix, block, and concrete products plants to improve air entrainment stability. It is particularly effective in maintaining air content during longer haul times. Darex II AEA performs well in conventional concrete and is effective in plasticizing mixes and with slag, lightweight, or manufactured aggregates which tend to produce harsh concrete.

Darex II AEA entrains air effectively with microsilica concrete and with fly ash concrete.

Performance

By agitation of concrete mixers, Darex II AEA disperses and generates millions of discrete semi-microscopic bubbles throughout the concrete composite. Once thoroughly mixed, the concrete contains a stable network of bubbles which act much like ball bearings increasing mobility, or plasticity, of the concrete. This aids workability to the mix and permits a reduction of water with no loss of slump. Placeability is improved. Bleeding, segregation and green shrinkage are minimized.

Through the purposeful entrainment of air, Darex II AEA markedly increases the durability of concrete to all exposures.

Product Advantages

- Air stability makes it particularly useful for longer transit times
- Produces excellent air void systems in concretes that are traditionally difficult to air entrain

Addition Rates

There is no standard addition rate for Darex II AEA. The amount to be used will depend upon the amount of air required under job conditions, usually in the range of 4 to 7%. Typical factors which might influence the amount of air entrained are temperature, cement, sand gradation, and use of extra fine materials such as fly ash. Typical Darex II AEA addition rates generally range from ½ to 5 fl oz/100 lbs (30 to 320 mL/100 kg) of cement.

The air-entraining efficiency of Darex II AEA becomes even greater when used with water-reducing and set-retarding agents. This may allow a reduction of up to ⅔ in the amount of Darex II AEA required for the specified air content.

Mix Adjustment

Entrained air results in increased yields with a consequent decrease in the cement content of the placed concrete. This condition calls for a mix adjustment, usually accomplished by reducing the fine aggregate content. This is in addition to the reduction in water content brought about by the increase in plasticity.

Compatibility with Other Admixtures and Batch Sequencing

Darex II AEA is compatible with most Grace admixtures as long as they are added separately to the concrete mix. In general, it is recommended that Darex II AEA be added to the concrete mix near the beginning of the batch sequence for optimum performance, preferably by "dribbling" on the sand. Different sequencing may be used if local testing shows better performance. Please see Grace Technical Bulletin TB-0110, *Admixture Dispenser Discharge Line Location and Sequencing for Concrete Batching Operations* for further recommendations. Darex II AEA should not be added directly to heated water.

Pretesting of the concrete mix should be performed before use, and as conditions and materials change in order to assure compatibility, and to optimize dosage rates, addition times in the batch sequencing and concrete performance. Please consult your Grace representative for guidance.

Packaging & Handling

Darex II AEA is available in bulk, delivered by metered tank trucks, totes and drums. **Darex II AEA will freeze at about 30°F (-1°C), but its air-entraining properties are completely restored by thawing and thorough mechanical agitation.**

Dispensing Equipment

A complete line of accurate dispensing equipment is available. These dispensers can be located to discharge into the water line, the mixer, or on the sand.

Specifications

Concrete shall be air entrained concrete, containing 4 to 7% entrained air. The air contents in the concrete shall be determined by the pressure method (ASTM Designation C231), gravimetric method (ASTM Designation C138) or volume metric method (ASTM Designation C173). The air-entraining admixture shall be Darex II AEA as manufactured by Grace Construction Products, or equal. The air-entraining admixture shall be added at the concrete mixer or batching plant at approximately ½ to 5 fl oz/100 lbs (30 to 320 mL/100 kg) of cement, or in such quantities as to give the specified air contents.

www.graceconstruction.com

North American Customer Service: 1-877-4AD-MIX1 (1-877-423-6491)

Darex is a registered trademark of W. R. Grace & Co.–Conn.

We hope the information here will be helpful. It is based on data and knowledge considered to be true and accurate and is offered for the users' consideration, investigation and verification, but we do not warrant the results to be obtained. Please read all statements, recommendations or suggestions in conjunction with our conditions of sale, which apply to all goods supplied by us. No statement, recommendation or suggestion is intended for any use which would infringe any patent or copyright. W. R. Grace & Co.–Conn., 62 Whittemore Avenue, Cambridge, MA 02140. In Canada, Grace Canada, Inc., 294 Clements Road, West, Ajax, Ontario, Canada L1S 3C6.

This product may be covered by patents or patents pending. Copyright 2007. W. R. Grace & Co.–Conn.

AIR-3H Printed in U.S.A. 11/07 FA/LI/1M

GRACE

BASF
The Chemical Company

3/4	03 30 00 03 40 00 03 70 00 04 05 16	**Product Data** Cast-in-Place Concrete Precast Concrete Mass Concrete Masonry Grouting

GLENIUM® 7500

High-Range Water-Reducing Admixture

Description

GLENIUM® 7500 high-range water-reducing admixture is based on the next generation of polycarboxylate technology found in all of the Glenium 7000 series products. This technology combines state-of-the-art molecular engineering with a precise understanding of regional cements to provide specific and exceptional value to all phases of the concrete construction process.

GLENIUM 7500 admixture is very effective in producing concrete mixtures with different levels of workability including applications that require self-consolidating concrete (SCC). The use of GLENIUM 7500 admixture results in faster setting characteristics as well as improved early age compressive strength. GLENIUM 7500 admixture meets ASTM C 494/C 494M provisional compliance requirements for Type A, water-reducing, and Type F, high-range water-reducing, admixtures.

Applications

Recommended for use in:

- Concrete with varying water reduction requirements (5-40%)
- Concrete where control of workability and setting time is critical
- Concrete where high flowability, increased stability, high early and ultimate strengths, and improved durability are needed
- Production of Rheodynamic® Self-Consolidating Concrete (SCC) mixtures
- 4x4™ Concrete for fast-track construction
- Pervious Concrete mixtures

Features

- Excellent early strength development
- Controls setting characteristics
- Optimizes slump retention/setting relationship
- Consistent air entrainment
- Dosage flexibility

Benefits

- Faster turnover of forms due to accelerated early strength development
- Reduces finishing labor costs due to optimized set times
- Use in fast track construction
- Minimizes the need for slump adjustments at the jobsite
- Less jobsite QC support required
- Fewer rejected loads
- Optimizes concrete mixture costs

Performance Characteristics

Concrete produced with GLENIUM 7500 admixture achieves significantly higher early age strength than first generation polycarboxylate high-range water-reducing admixtures. GLENIUM 7500 admixture also strikes the perfect balance between workability retention and setting characteristics in order to provide efficiency in placing and finishing concrete.

Guidelines for Use

Dosage: GLENIUM 7500 admixture has a recommended dosage range of 2-15 fl oz/cwt (130-975 mL/100 kg) of cementitious materials. For most applications, dosages in the range of 5-8 fl oz/cwt (325-520 mL/100 kg) will provide excellent performance. For high performance and Rheodynamic Self-Consolidating Concrete mixtures, dosages of up to 12 fl oz/cwt (780 mL/100 kg) of cementitious materials can be utilized. Because of variations in concrete materials, jobsite conditions and/or applications, dosages outside of the recommended range may be required. In such cases, contact your local BASF Construction Chemicals representative.

Mixing: GLENIUM 7500 admixture can be added with the initial batch water or as a delayed addition. However, optimum water reduction is generally obtained with a delayed addition.

Master Builders

Product Notes

Corrosivity – Non-Chloride, Non-Corrosive: GLENIUM 7500 admixture will neither initiate nor promote corrosion of reinforcing steel embedded in concrete, prestressing steel or of galvanized steel floor and roof systems. Neither calcium chloride nor other chloride-based ingredients are used in the manufacture of GLENIUM 7500 admixture.

Compatibility: GLENIUM 7500 admixture is compatible with most admixtures used in the production of quality concrete, including normal, mid-range and high-range water-reducing admixtures, air-entrainers, accelerators, retarders, extended set control admixtures, corrosion inhibitors, and shrinkage reducers.

Do not use GLENIUM 7500 admixture with admixtures containing beta-naphthalene sulfonate. Erratic behaviors in slump, workability retention and pumpability may be experienced.

Storage and Handling

Storage Temperature: GLENIUM 7500 admixture must be stored at temperatures above 40 °F (5 °C). If GLENIUM 7500 admixture freezes, thaw and reconstitute by mechanical agitation.

Shelf Life: GLENIUM 7500 admixture has a minimum shelf life of 6 months. Depending on storage conditions, the shelf life may be greater than stated. Please contact your BASF Construction Chemicals representative regarding suitability for use and dosage recommendations if the shelf life of GLENIUM 7500 admixture has been exceeded.

Packaging

GLENIUM 7500 admixture is supplied in 55 gal (208 L) drums, 275 gal (1040 L) totes and by bulk delivery.

Related Documents

Material Safety Data Sheets: GLENIUM 7500 admixture.

Additional Information

For additional information on GLENIUM 7500 admixture or on its use in developing concrete mixtures with special performance characteristics, contact your BASF Construction Chemicals representative.

The Admixture Systems business of BASF Construction Chemicals is a leading provider of innovative additives for specialty concrete used in the ready mix, precast, manufactured concrete products, underground construction and paving markets throughout the NAFTA region. The Company's respected Master Builders brand products are used to improve the placing, pumping, finishing, appearance and performance characteristics of concrete.

BASF Construction Chemicals, LLC
Admixture Systems
www.masterbuilders.com
United States 23700 Chagrin Boulevard, Cleveland, Ohio 44122-5544 ■ Tel: 800 628-9990 ■ Fax: 216 839-8821
Canada 1800 Clark Boulevard, Brampton, Ontario L6T 4M7 ■ Tel: 800 387-5862 ■ Fax: 905 792-0651

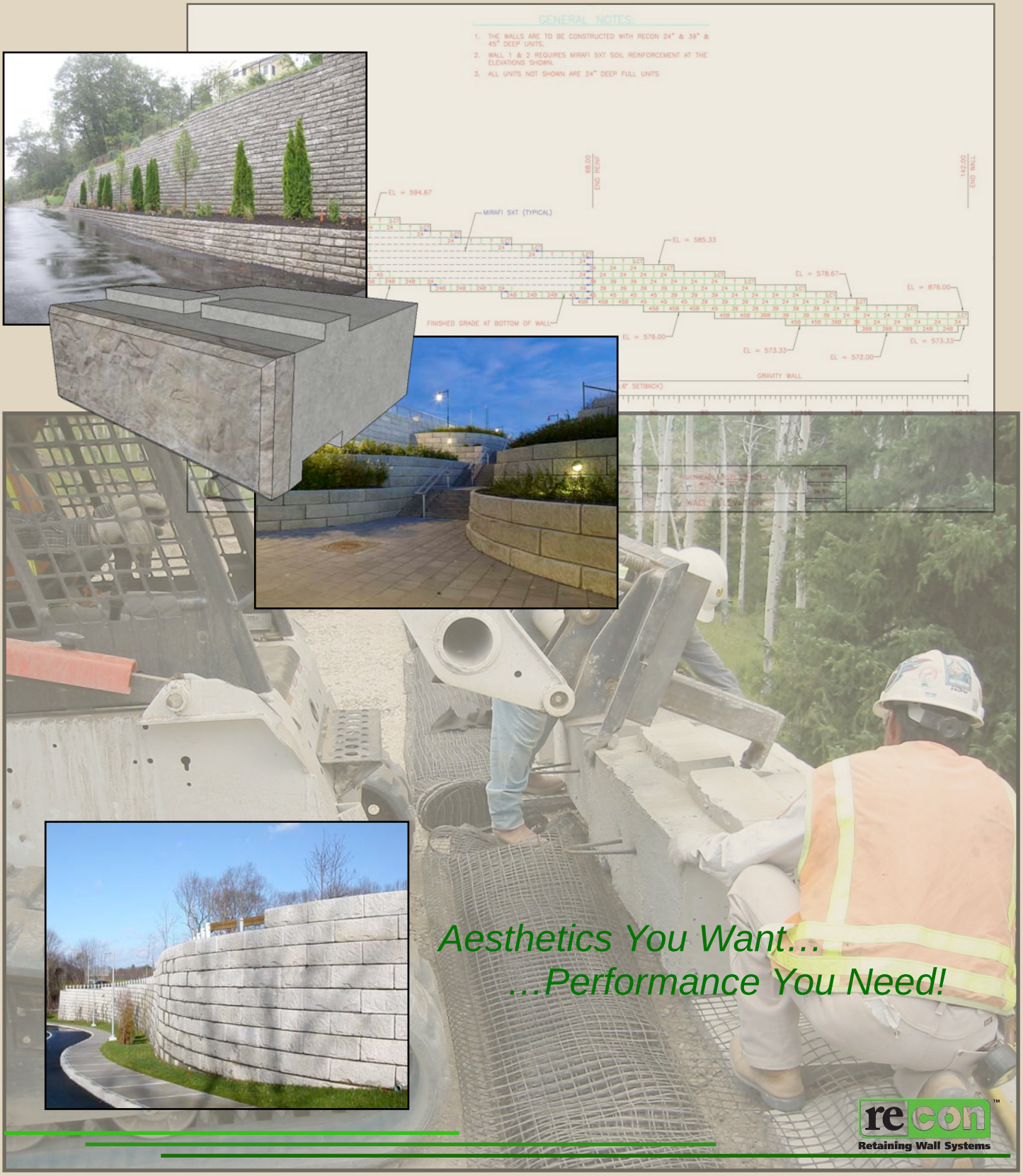
® Construction Research & Technology GMBH

© BASF Construction Chemicals, LLC 2007 ■ Printed in USA ■ 03/07 ■ LIT # 2000025

Master Builders

Design and Construction Reference Manual

ReCon Series 50



Aesthetics You Want…
…Performance You Need!

recon™
Retaining Wall Systems

recon
Retaining Wall Systems

Aesthetics You Want...
...Performance You Need!

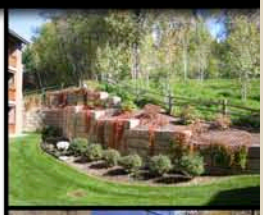
Scale...
Each block really is a block

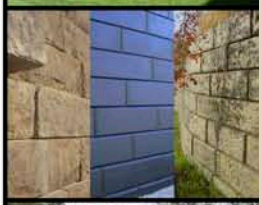
Texture...
Not one choice, but three

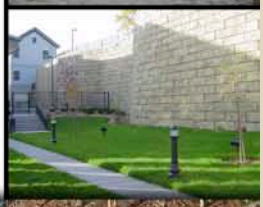
Shapes...
Flexibility and choices that work

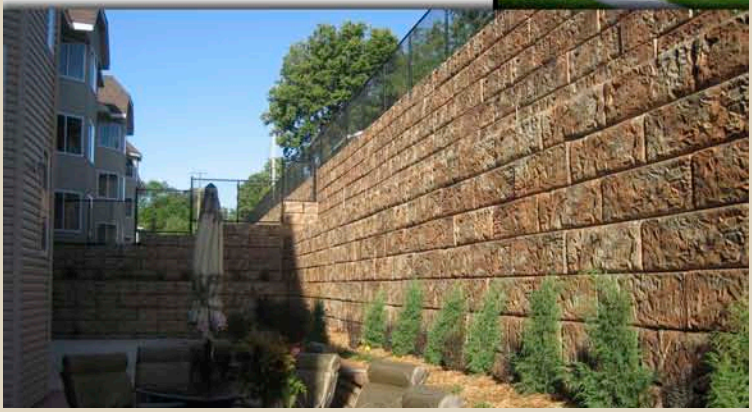
Durability...
Wet-Cast, Air-Entrained Concrete

Solutions...
A product that doesn't dictate wall needs: **It accommodates them!**







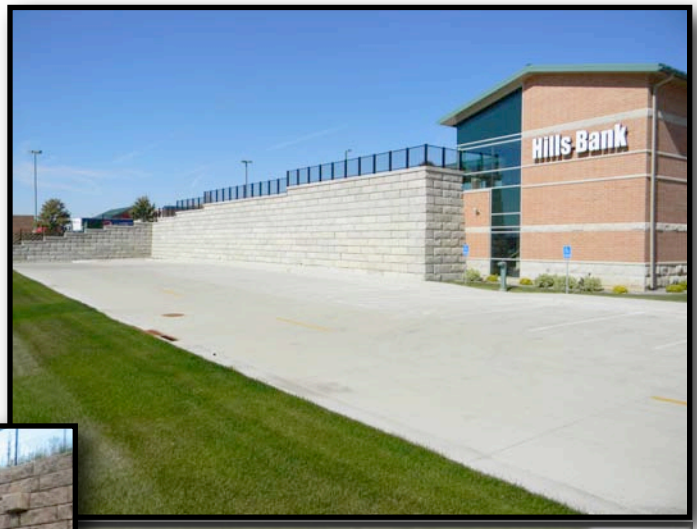


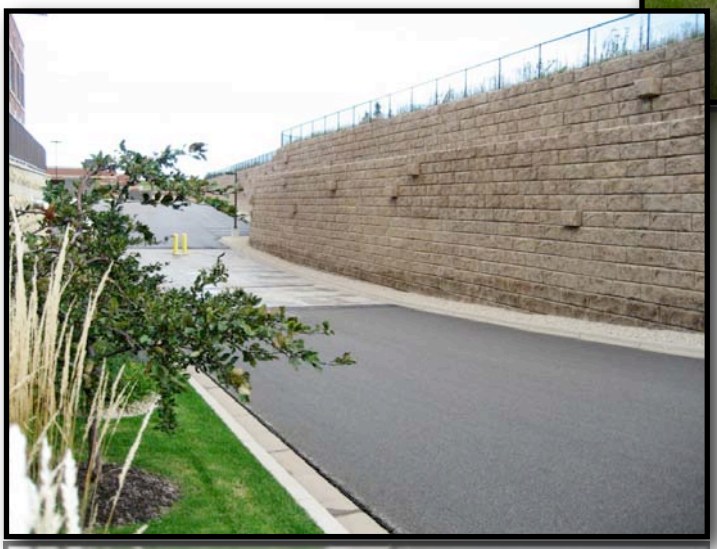
www.reconwalls.com

Introduction

At ReCon, we are proud of our tradition of offering a product line that adds value for our customers, and for our wall design and wall contractor partners. Whether the ReCon application focuses on the scale and aesthetics of the ReCon Block, the durability of the wet-cast, air-entrained concrete, the considerable gravity wall heights that can be achieved, or the construction efficiencies associated with our product, it is our intention to solve site specific challenges and add value.

The design of a ReCon segmental retaining wall may be fairly straightforward or it may be quite complex and involve a high degree of geotechnical and/or civil engineering expertise. At first glance, the steps involved in construction of a ReCon retaining wall appear relatively simple. In fact, they are; however, it is critical that these procedures are done properly if the wall is to last and perform as designed. This is due to the fact that the ReCon units themselves are often just a key component in what is a more complex and inter-dependent composite earthen structure. A number of important variables must be analyzed before a proper wall design can be finalized.





This manual is intended to provide wall designers, wall installers and others with the information useful in the design, the construction and cost estimation of a ReCon retaining wall that will remain attractive and structurally stable for the duration of its intended design life.

Table Of Contents

ReCon Series 50 Shapes Data 5

- **Shapes** 5
- **Textures** 8
  - *Le Sueur County Limestone* 8
  - *North Shore Granite* 8
  - *Old World* 8
  - *Rustic* 8

Design Parameters 9

- **Wall Geometry** 9
- **Soils Information** 9
- **Unit Characteristics** 11
- **Water / Drainage** 12
- **Surcharges** 13
- **Terraced Walls** 14
  - *Terraced Wall “2:1” General Rule* 14

Wall Construction 15

- **Site Preparation** 15
- **Excavation** 15
- **Preparing the Leveling Pad** 15
- **Base Course Installation** 16
- **Backfilling and Compaction** 17
- **Placing Additional Courses** 17
- **Geogrid Placement** 18
- **Curved Walls** 19
  - *Reinforcement Placement on Curved Walls* 20
- **Outside 90 Degree Corners** 21
- **Inside 90 Degree Corners** 21
- **Double Outside 90 Degree Corners** 22
- **Outside 90 Degree Corner to Abutment** 22
- **Top of Wall Treatments** 23
  - *ReCon Top Units* 23
  - *Cap Units* 24
  - *Full-High Cap Units* 25
  - *Steps* 25
- **Railings and Guardrails** 26
- **Staining and Sealing** 26

ReCon “Series 50” Guide Specification 27

Increasing Gravity Wall Heights 32

Typical Gravity Wall Section 33

Series 50 Standard Design Charts 34

- **Gravity Walls** 34
- **Geogrid Reinforced Walls** 35

Warranty 38

ReCon Series 50 Shapes Data

Shapes

ReCon Series 50 units are available in a large variety of shapes. These shapes are designed to enhance the aesthetic appearance of a finished retaining wall. In addition, the large selection provides for ease and simplicity in the installation process without adding undue complexity for designers, installers and manufacturers alike.

The shapes shown are representative of the most common ReCon Series 50 block shapes.

Actual block shapes and texture options vary by region. Check with your local supplier to determine availability.

Because ReCon Series 50 units are manufactured from wet-cast, air-entrained concrete, they lend themselves to a varying degree of customization. Many existing shapes and face textures were originally developed to accommodate the needs of an owner, designer or installer. If some unique shape or texture is required it may be possible to develop products not already available. Given a reasonable amount of time, ReCon manufacturers should be able to determine the viability and cost estimate of such a request.

Name Full Base Block - 24”

Unit ID	Weight	Dimensions
FB24	1457	16 in. x 48 in. x 24 in.

Volume 10.04

Coverage 5.33

Batter 3.6°

Name Full Middle Block - 24”

Unit ID	Weight	Dimensions
FM24	1411	16 in. x 48 in. x 24 in.

Volume 9.73

Coverage 5.33

Batter 3.6°

Name Full Base Block - 39”

Unit ID	Weight	Dimensions
FB39	2276	16 in. x 48 in. x 39 in.

Volume 15.7

Coverage 5.33

Batter 3.6°

Name Full Middle Block - 39”

Unit ID	Weight	Dimensions
FM39	2201	16 in. x 48 in. x 39 in.

Volume 15.18

Coverage 5.33

Batter 3.6°

Name Full Base Block - 45”

Unit ID	Weight	Dimensions
FB45	2550	16 in. x 48 in. x 45 in.

Volume 17.58

Coverage 5.33

Batter 3.6°

Name Full Middle Block - 45”

Unit ID	Weight	Dimensions
FM45	2491	16 in. x 48 in. x 45 in.

Volume 17.18

Coverage 5.33

Batter 3.6°

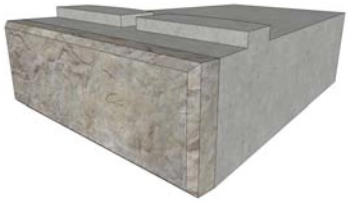
Name Full Base Block - 60”, 66”, 72”, 78”, 84”

Unit ID	Weight	Dimensions
FB60-84	3173-4146	16 in. x 48 in. x varies

Volume
21.88-28.59

Coverage
5.33

Batter
3.6°



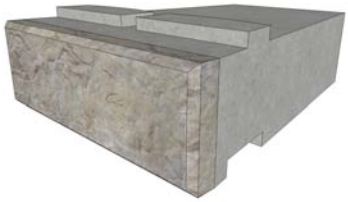
Name Full Middle Block - 60”, 66”, 72”, 78”, 84”

Unit ID	Weight	Dimensions
FM60-84	3115-4088	16 in. x 48 in. x varies

Volume
21.48-28.19

Coverage
5.33

Batter
3.6°



Name Full Channel Block

Unit ID	Weight	Dimensions
CHAN	2201	16 in. x 48 in. x 39 in.

Volume
15.18

Coverage
5.33

Batter
26.5

Name Full Top Block - 24”

Unit ID	Weight	Dimensions
T24	971	16 in. x 48 in. x 24 in.

Volume
6.7

Coverage
5.33

Batter
3.6°

Name Half Middle Block - 24”

Unit ID	Weight	Dimensions
HM24	662	16 in. x 24 in. x 24 in.

Volume
4.57

Coverage
2.67

Batter
3.6°

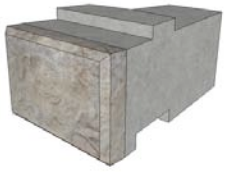
Name Half Middle Block - 39”

Unit ID	Weight	Dimensions
HM39	967	16 in. x 24 in. x 39 in.

Volume
6.67

Coverage
2.67

Batter
3.6°



Name Half Top Block - 24”

Unit ID	Weight	Dimensions
HT24	458	16 in. x 24 in. x 24 in.

Volume
3.16

Coverage
2.67

Batter
3.6°

Name Left Corner Top Block

Unit ID	Weight	Dimensions
LCT	1103	16 in. x 48 in. x 24 in.

Volume
7.61

Coverage
8

Batter
3.6°

Name Right Corner Top Block

Unit ID	Weight	Dimensions
RCT	1103	16 in. x 48 in. x 24 in.

Volume
7.61

Coverage
8

Batter
3.6°

Name Reversible Corner Block

Unit ID	Weight	Dimensions
C	1401	16 in. x 48 in. x 24 in.

Volume
9.66

Coverage
8

Batter
3.6°

Name Fitting Block - 24”

Unit ID	Weight	Dimensions
FF24	1215	16 in. x 48 in. x 24 in.

Volume
8.38

Coverage
5.33

Batter
3.6°

Name Three Quarter Block - 24”

Unit ID	Weight	Dimensions
TOM24	1037	16 in. x 36 in. x 24 in.

Volume
7.15

Coverage
4

Batter
3.6°

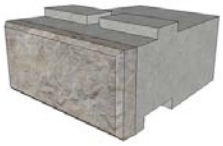
Name Three Quarter Block - 39”

Unit ID	Weight	Dimensions
TOM39	1586	16 in. x 36 in. x 39 in.

Volume
10.94

Coverage
4

Batter
3.6°



Name Capstone

Unit ID	Weight	Dimensions
CAP	600	6.5 in. x 48 in. x 26 in.

Volume
4.13

Coverage
2.17

Batter
N/A

Name End Capstone

Unit ID	Weight	Dimensions
ECAP	600	6.5 in. x 48 in. x 26 in.

Volume
4.13

Coverage
2.17

Batter
N/A

Name Full-High Cap Middle Block

Unit ID	Weight	Dimensions
FHCAPM	1459	16 in. x 48 in. x 24 in.

Volume
10.06

Coverage
10.66

Batter
0°

Name Full-High Cap End Block

Unit ID	Weight	Dimensions
FHCAPE	1450	16 in. x 48 in. x 24 in.

Volume
10.0

Coverage
13.33

Batter
0°

Name Step Unit

Unit ID	Weight	Dimensions
STEP	680	6.5 in. x 48 in. x 26 in.

Volume
4.69

Coverage
2.17

Batter
N/A

Name Plinth Block

Unit ID	Weight	Dimensions
PLB	1486	16 in. x 24 in. x 47 in.

Volume
10.25

Coverage
2.67

Batter
3.6°

Textures

ReCon currently offers its licensed manufacturers a choice of four types of face textures. Most producers choose one of these textures as their standard and elect to maintain a working inventory of that texture. Other textures may still be available as a special order. As with most special orders, additional costs may be involved and sufficient time should be allowed for setup and production. Check with the ReCon licensed manufacturer in your market to determine what textures are available.

1) Le Sueur County Limestone

This texture offers the look of a broken and weathered limestone. This texture lends itself well to accent staining. When certain stain colors are used, Le Sueur County Limestone can also take on the appearance of a weathered sandstone material.

2) North Shore Granite

Granite may be the most universally recognized natural stone on earth. While its coloration varies widely, the texture of an unprocessed granite is somewhat consistent in the way it fractures due to its composition and density. Stained or unstained, the appearance of North Shore Granite can be nearly indistinguishable from weathered natural stone.

3) Old World

ReCon's Old World texture was originally developed as a "special order" to match the appearance of the popular cut stone building materials used in the late 1800's and early 1900's. Many different types of stone were used in this manner and the Old World texture can emulate most of them depending on the stains that are used. The face also lends itself to further processing, such as sandblasting or using a retarder to expose aggregates.

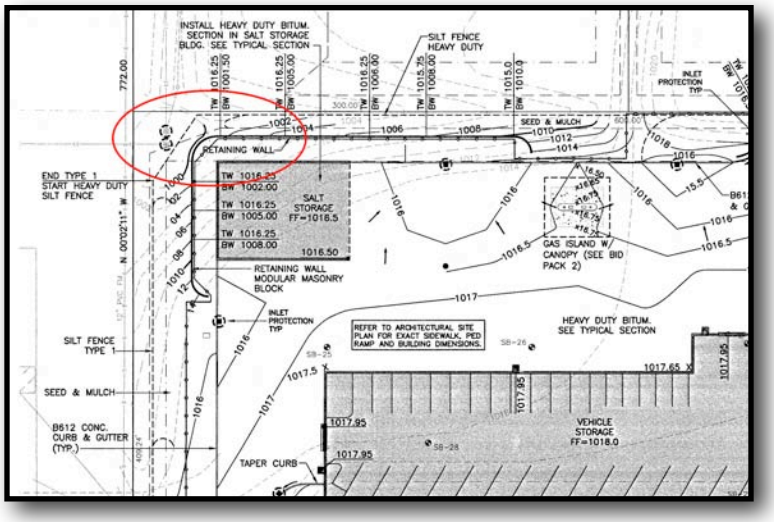
4) Rustic

The Rustic Stone texture captures the authenticity of a natural weathered cut stone that has been stacked in eight-inch coursing. The length of the individual stones varies from as little as eight inches to as much as twenty-six inches, resulting in a natural random pattern.

Design Parameters

Wall Geometry

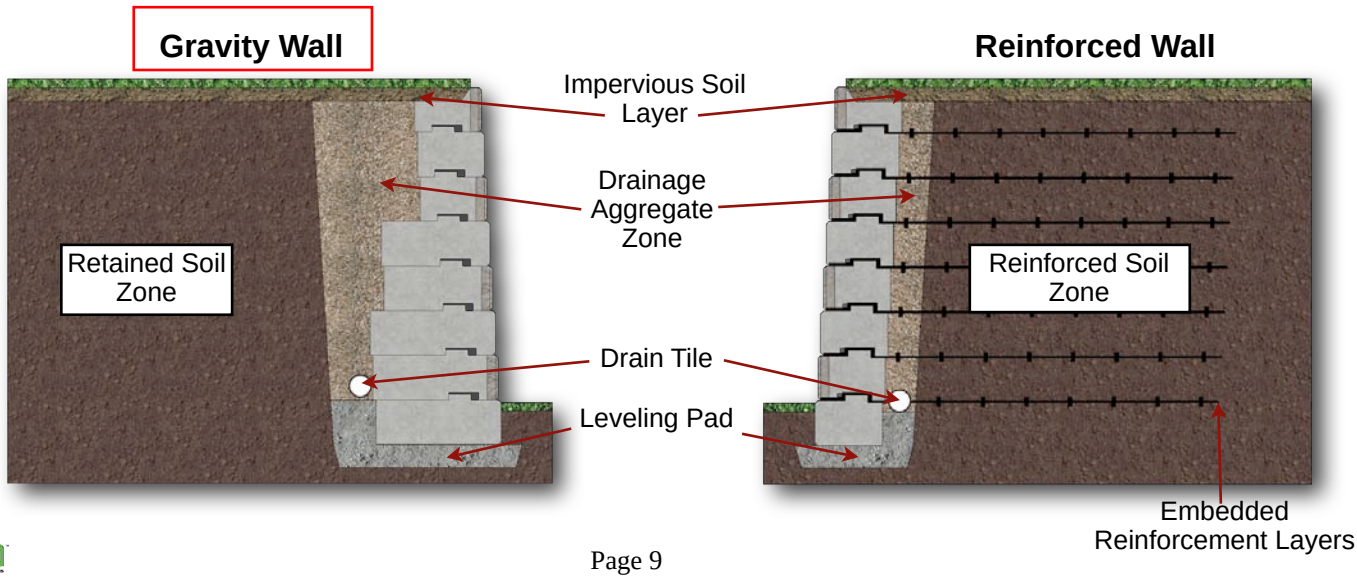
When planning a ReCon retaining wall, the most logical place to start is the wall location and where it resides with reference to the project site and topography. For most commercial projects this information is usually found on the site-grading plan. A great deal of the information necessary to properly design a ReCon retaining wall can be found there. In addition to the calculation of wall heights and lengths, designers study this plan in order to gather information about adjacent structures, surcharges, site access, property lines, utility locations and site drainage. All of these factors influence the final design and construction of a ReCon retaining wall.



For projects that don't have a formal site-grading plan, wall designers still need this information to be gathered, even if perhaps in a less formal way. Regardless of the source, access to this information is critical to proper design; determination of unit types; and the formulation of accurate unit quantities and cost estimates.

Soils Information

Segmental retaining walls (SRWs) are by definition a soil structure with a modular and mortarless aesthetic facing. In some cases, the facing itself can provide sufficient resistance to natural soil forces and potential wall movement. When this is true, the wall is commonly referred to as a "gravity wall". **The ability to construct taller gravity walls is one of the key advantages of the ReCon Series 50 retaining wall system.** How and why ReCon can achieve these heights will be addressed in the appropriate sections of this manual. When the mass, footprint and other properties of the facing units are insufficient to restrain movement of a given segmental retaining wall structure, soil reinforcement is introduced to the soil mass behind the wall to increase stability. These composite structures are commonly referred to as reinforced segmental retaining walls or "MSE walls", which is an acronym for "mechanically stabilized earth".



If soil is a main component of an SRW structure, then it is necessary for wall designers to know and understand the properties of these soils. Soils come in a “near infinite” number of types and compositions. In commercial projects, SRW wall designers often learn about the properties of the soils on a project site from a Soil Boring Log. Knowledgeable civil or geotechnical engineers evaluate this information in order to predict a completed SRW’s performance. In the absence of detailed soils information, wall designers must make some assumptions about the soil properties in order to proceed. When assumptions about soils must be made, they are usually, and should be, conservative in order to preserve the necessary safety factors for wall integrity. There are some soils that should never be used in a SRW. A detailed discussion of all soil types and properties is beyond the scope of this manual. The determination of particular soil suitability for use in a SRW rightfully belongs within the realm of a trained and experienced civil or geotechnical engineer.

The soils that are of critical interest to a wall designer are categorized into five basic “zones” with respect to their location in and around the finished wall.

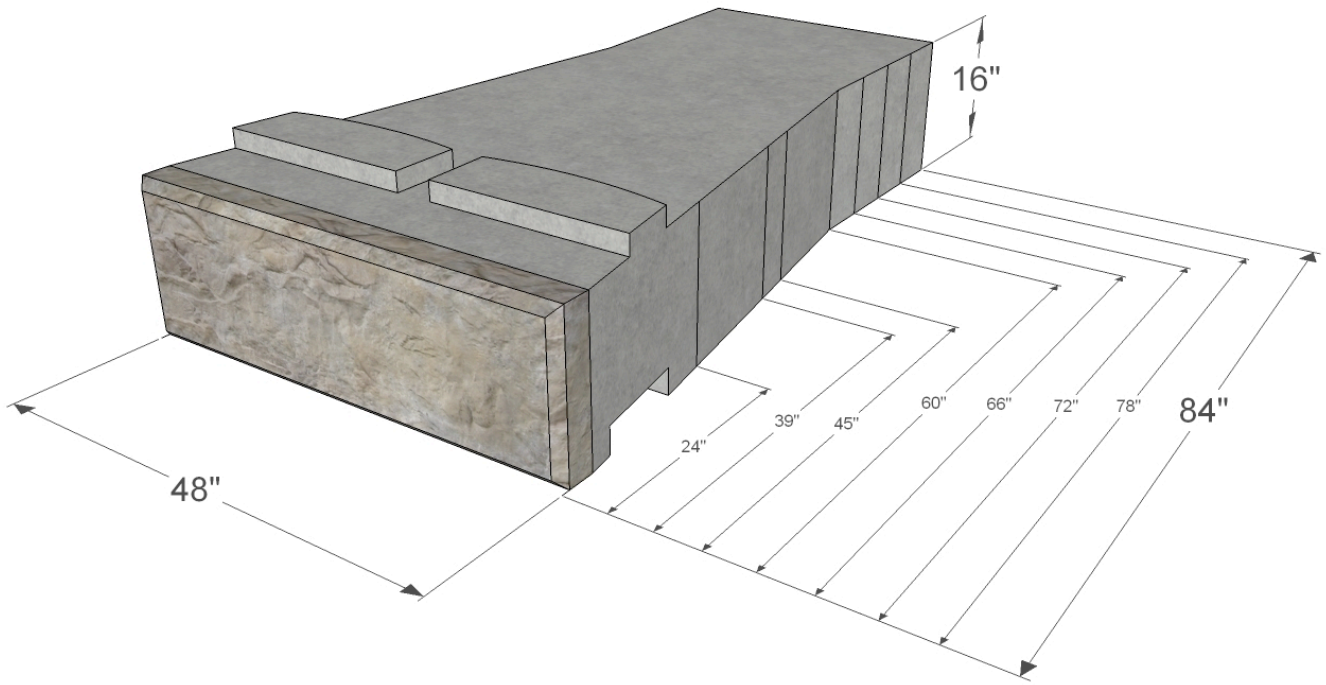
1) The *leveling pad* is not really a zone, per se, but is an integral and necessary part of a well-designed, well-built SRW. It consists of a material similar to that of road gravel that allows for drainage, but also contains enough fines to allow it to compact well and “hold its shape”. Class 5, ¾” minus, crush & run and road base are some of the regional names given to this type of material. The dimensions for the leveling pad vary and are discussed elsewhere in this manual.
2) The *drainage zone* is typically an imported, well-draining crushed rock material that fills the voids in and around the facing units to a minimum depth of one foot behind the back of the facing. This zone functions as a “French drain” to transport water otherwise trapped behind the finished wall to a drainage collection or dispersal area. This material should be relatively free of fine-grained materials and also should be “self-compacting”. This eliminates the need to operate compaction equipment in close proximity to the back of the wall facing.
3) The *foundation soil zone* comprises the area immediately beneath the facing components and drainage zone and is responsible for providing adequate support for the weight of the retained wall above. If the wall is a reinforced SRW, the foundation zone also extends beneath and behind the wall to a distance roughly equal to the depth of the embedded soil reinforcement.
4) The *reinforced soil zone* only exists in MSE walls and extends from the back of the drainage zone to an embedded depth equal to the back of the geosynthetic soil reinforcement. This soil may have its origin on-site or it can be a “select fill” material brought on-site from elsewhere. The properties of this material strongly influence the performance characteristics of the reinforced soil mass and, as such, have a significant effect on the strength, length and quantity of soil reinforcement in the finished wall. Ultimately, the design of a finished soil-reinforced wall is greatly affected by the material confined within this soil zone.
5) The *retained soil zone* is the material either behind the reinforced soil zone, in the case of a soil-reinforced SRW, or behind the drainage zone in a gravity retaining wall. Soil characteristics within this zone also have a significant effect on the design of the finished wall in the same way that the reinforced soil zone does.

Unit Characteristics

There are a number of characteristics of the wall facing units themselves that contribute to the final SRW wall design.

1.Dimensions
    A.Height
    B.Width
    C.Depth
2.Weight
    A.Volume
    B.Density
    C.Center of Gravity
    D.Infill Weight
3.Unit Setback / Wall Batter
4.Durability

These key characteristics are listed in the ReCon shapes chapter.



FULL MIDDLE UNIT

Density - >135 lbs./cu. ft.
Weight - 1411 to 4146
Volume - 9.73 to 28.59
Batter - 3.6°

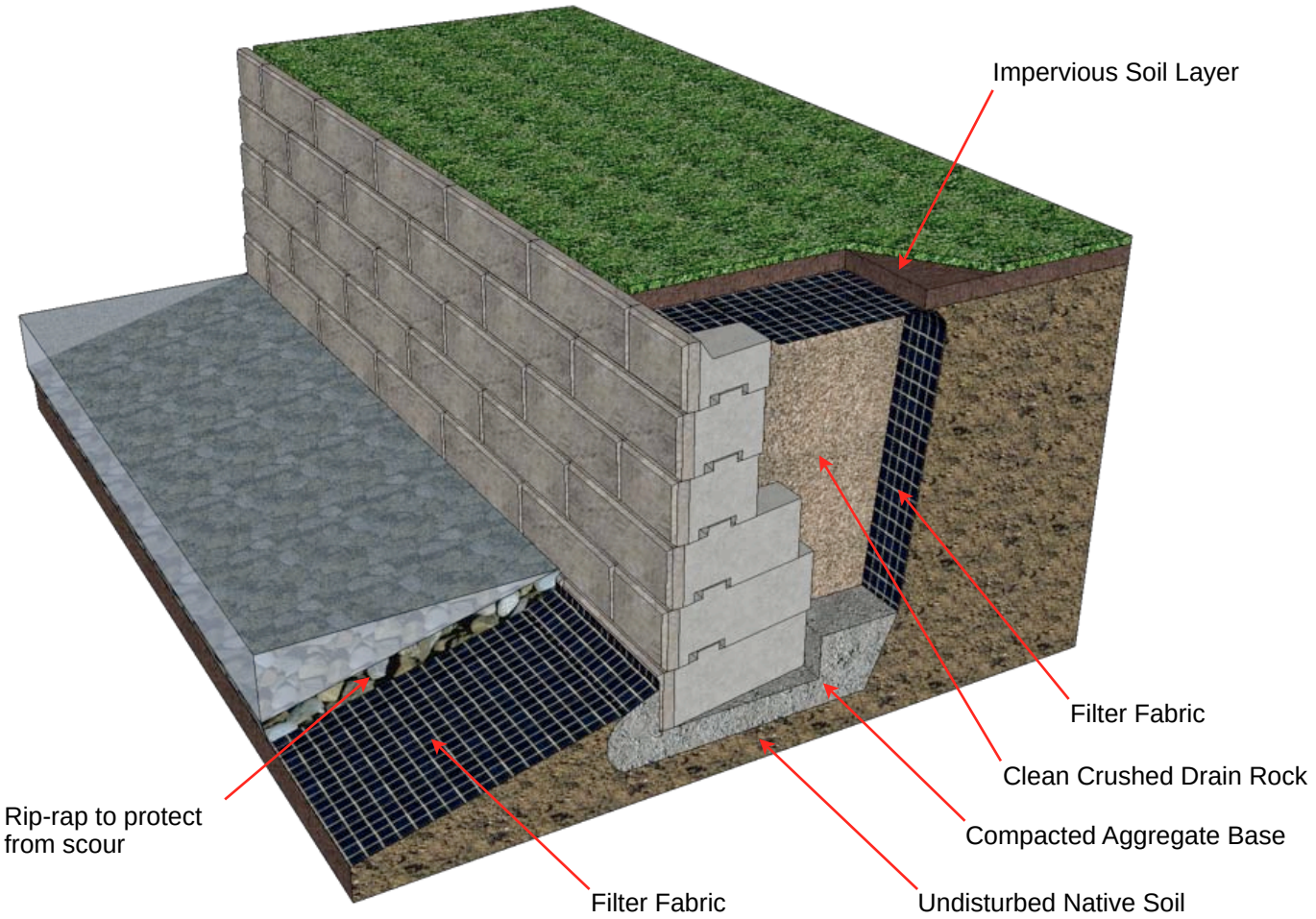
Water / Drainage

Most problems associated with SRWs can be traced back, directly or indirectly, to water. The presence of water, whether or not anticipated, affects soil mechanics and places extra strain on a finished wall. Water trapped behind a wall greatly increases retained pressures. A high water table can weaken foundation soils to the point where they are unable to continue to support the wall. Moving water over the top or along the bottom of a finished wall can erode away the soil to the point where the wall becomes unstable and must be rebuilt. Finally, drainage must be considered during the construction period as well as when the wall and final grading is completed. Water “traffic” on an unfinished project site can be entirely different than what is designed for and intended on the completed project. In short, the presence of water accentuates weaknesses in wall design and/or construction. As such, care must be taken to avoid these water issues when designing and installing a ReCon “Series 50” retaining wall.

By the same token, ReCon “Series 50” units are an excellent choice for the unique challenges that water applications present. The durability, mass, footprint and specific gravity of a “Series 50” wall enables designers to comfortably tackle these applications.

Shoreline or seawall retaining wall applications are unique and should be treated as such. The design for these applications can vary significantly. Consult a qualified wall design engineer for these situations and make sure to check all governing code requirements.

The following diagram illustrates some of the special construction and design elements of a typical water application.



Surcharges

When a SRW is exposed to additional loads, whether permanent or temporary, the overall wall design is affected. Usually, when a structure, building, roadway or top slope is within twice the height of the SRW wall face, its impact on the stability of the wall must be evaluated. This is only a general rule based on the most common soil types. Wall design engineers must consider many other factors which may adjust this proximity formula.

Surcharges may stabilize or destabilize a ReCon wall, depending on their type and / or relative proximity to the wall.

By definition, surcharges are usually classified as a “live load” or “dead load”. A live load is generally temporary in nature. An example might be a fully loaded semi truck traveling along a roadway within close proximity to the finished SRW. Because it is by definition temporary, any stabilizing contribution of a live-load surcharge is usually ignored. Ultimately, this results in a more conservative design with an improvement in the overall safety factors for certain aspects of the wall design.

A dead load, by contrast, is intended to be permanent. Although it will increase stresses on the wall depending on its type and proximity to the wall, it can also contribute to certain aspects of wall stability. Examples of a dead load could be a slope above the wall that adds the extra weight of the soil mass and must be accounted for in the wall design; or it may be a building exerting additional weight through its foundation or footing. Another common type of dead load found on SRW sites results from wall terracing. When a second (or third, etc.) SRW is built above another it needs to be evaluated to see if it is imposing additional stresses on the wall (or walls) beneath it.

Terraced Walls

Terraced walls are a common feature in retaining wall applications. From an engineering standpoint, these walls must be treated as a single composite structure if their proximity, in conjunction with other site and soil parameters, is such that an upper wall places additional load or stress on the wall (or walls) below.

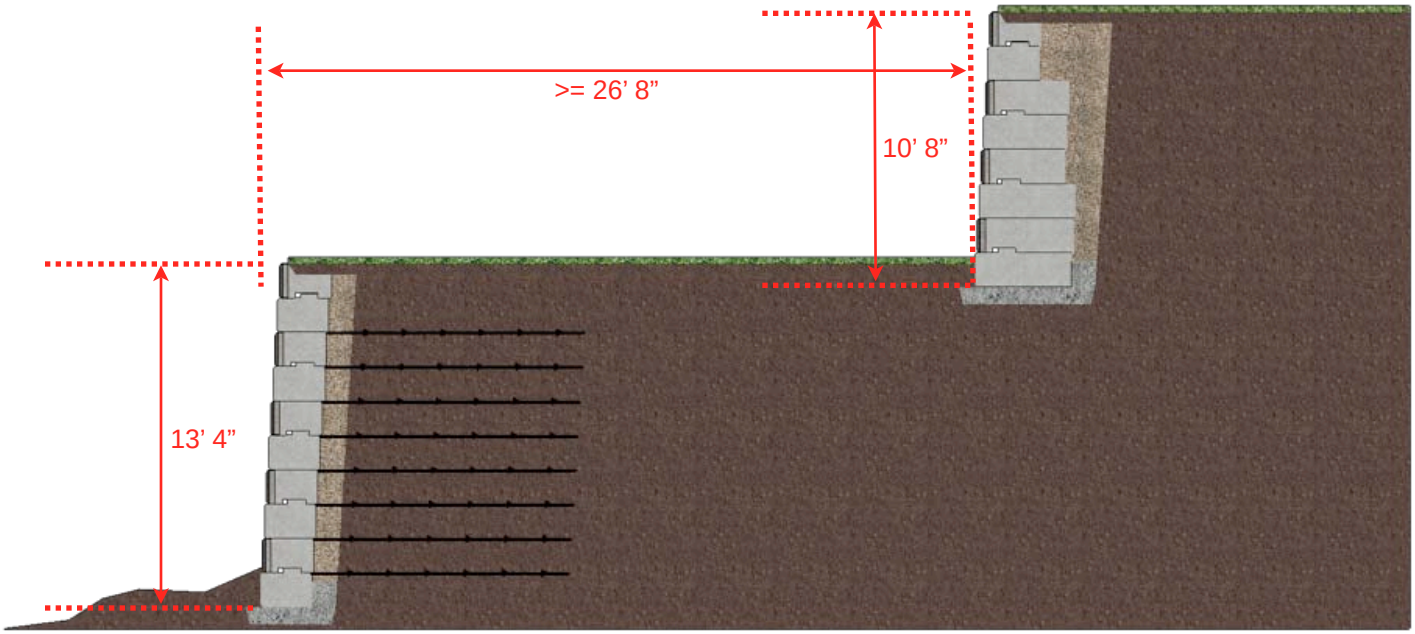
Most terraced walls may be considered independent of each other if they meet the requirements of the following rule of thumb.

Terraced Wall "2:1" General Rule

"Terraced walls may generally be considered independent of each other if… 1) the height of the upper wall is less than or equal to the height of the lower wall and… 2) the distance between the two walls is at least twice the height of the lower wall."

This general rule may not apply if soils are very poor, if toe or crest slopes are involved, or if there are additional surcharges present.

Terraced walls that do not meet the "2:1" rule usually require additional mass and / or soil reinforcement incorporated into the lower wall design in order to resist the additional stress incurred from the upper wall or walls.



Terraced Wall Example

Wall Construction

The following procedures comply with the generally accepted industry standards for the installation of segmental retaining walls with special attention given to the unique features of the ReCon “Series 50” product line. Every attempt should be made to follow these procedures as closely as possible unless the project specifications, drawings or the final engineered wall design directs otherwise. An installer should also reference the ReCon “Series 50” Installation Guidelines and Typical Construction Detail Drawings available at www.reconwalls.com.

Site Preparation

Before beginning work, contractors should make sure that they have thoroughly studied the project specifications, the final engineered drawings for the wall and complied with all the requirements for product submittals. Contractors should also have a clear understanding of their scope of work and their responsibilities that may be covered elsewhere in the project specifications and are not in the actual wall construction section.

For projects that do not have a formal set of plans and specifications but do have a “signed and stamped” final engineered wall plan, the contractor should refer to these procedures whenever a topic is not specifically covered in the final engineered plan.

Excavation

The contractor should carefully excavate the wall construction area to the lines and grades shown on the construction drawings. Exercise caution to keep the soil undisturbed in areas that will not need modification during wall construction. Be sure to identify above and below ground utilities including power lines, communication lines, sewer and drainage structures, etc.

Preparing the Leveling Pad

Excavate a trench to a minimum thickness of 6 inches and to a width that extends a minimum of 6 inches in front and behind the actual location of the base units along their designated placement. If the wall layout requires either inside or outside radius curves, it is a good idea to increase the width of the leveling pad to accommodate adjustment during wall alignment. For all but straight walls where the bottom elevation doesn’t

change along the entire length of the wall, stakes should be driven to the proper height as determined by a transit to indicate the proper bottom elevation of the wall. These stakes should also show where base step-ups are located. Bear in mind that each step-up causes the leveling pad location to step back by one inch due to the integral setback of ReCon “Series 50” units.

Fill the trench and any over-excavated areas with the specified base material. Unless specified otherwise, this material should generally consist of a well-draining material that also contains enough fines that the leveling pad will hold its shape after compaction. Depending on the region, this material may be referred to as road base, ¾” minus, crush and run or Class 5. Fully compact the base material and add or remove material as necessary to keep the leveling pad as close to the final level grade as possible. Where step-ups are located, base material should taper up at roughly a 45° angle.

At times a concrete leveling pad may be required or desirable in lieu of a compacted granular base material. Unless the leveling pad is designed as a true “footing” and extends below frost depth, the concrete should not contain steel reinforcing and should consist of a relatively weak mix capable of breaking up under frost pressures. This allows for resettlement as the frost dissipates. Also, when using a concrete leveling pad take extra care to keep the pad level and any step-ups at their proper height to avoid difficulty in maintaining height tolerances.

Base Course Installation

The first (base) course of a ReCon wall requires the use of a *Base Block.* This unit does not have the special groove on the bottom. This makes for easier leveling of the base course and also provides greater shear resistance at the interface between the leveling pad and ReCon base block.

Walls should generally be built starting at the lowest point in the wall. Make sure to properly place the edge of the first unit at an even 2 foot increment from any fixed wall features such as a 90° corner, a control joint or building structure. This helps to avoid unnecessary cutting or trimming of the ReCon units and improves wall aesthetics.

Depending on the type of material used for the leveling pad and how level the pad is to start with, base course leveling may be easier if the leveling pad is topped and screed with up to ½” of clean sand. On long straight sections of wall, it may be helpful to set units with a canter or tip-back of up to ½”. This increases the ability to maintain a positive wall batter and minimize rotation during soil compaction when robust compaction equipment is used.

As base units are laid, ensure that the units are in full contact with the leveling pad and check to ascertain that the units are level both front-to-back and left-to-right. Use a jig if necessary to maintain a consistent leveling plane from unit-to-unit. Lay units end-to-end and avoid gaps between units. The use of a string line will help ensure proper wall alignment along straight sections of wall. After the base units have been placed and before compacting the backfill material behind the wall, compaction to the specified embedment depth should be done in front of the wall.

Backfilling and Compaction

When all the units comprising a section of wall at a single elevation have been placed, aligned and leveled, fill the gaps between the units with a clean crushed rock material at least ½" – ¾" in size. Use this same material behind the back of the block to a depth of at least 1' or as otherwise indicated in the final engineered drawings. This material serves as a "French drain" to relieve water build-up and also, because it is self-compacting, it relieves installers from having to operate compaction equipment close to the back of the units.

At times, a **filter fabric** may be specified behind the drainage aggregate material. This helps keep the drainage zone clean and free from sedimentation. If present, wrap the fabric forward over the drainage aggregate as the other backfill material is placed.

When **drain tile** is used, it should be located as shown in the plans or drawings. Generally, the drain tile runs along the back of the wall and is at the bottom of the drainage aggregate zone at an elevation at or above the bottom finished grade level. Drain tile should "daylight" at least every 50' along the length as well as at every low point in the wall or as otherwise specified.

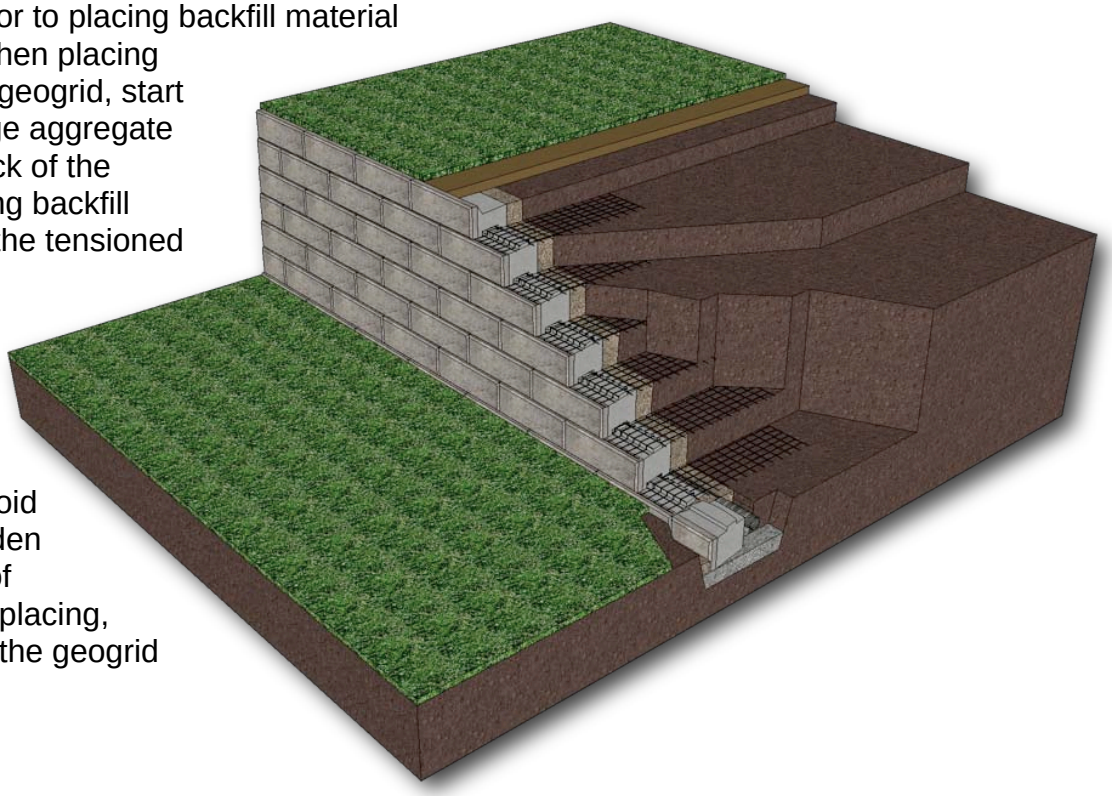
Place the specified backfill material and thoroughly compact material in 8" lifts. Backfill material should be compacted to 95% of standard proctor. **Improper or inadequate compaction is a primary source of contractor-caused wall failures.** Close attention should be paid to changes in consistency and moisture content of all backfill material. Use the proper type of compaction equipment. Sandy or gravelly materials respond best to plate compaction equipment and clayey materials usually should be "kneaded" by using a hand-operated "jumping jack" or "sheep's foot ". Heavy-duty compaction equipment should be kept a minimum of 5' from the back of the ReCon Wall to avoid wall rotation.

Placing Additional Courses

Prior to placing successive courses, sweep and keep clean any backfill material from the top of the ReCon units and make sure that all voids are filled with the proper drainage material. Place the next course in a running bond pattern or as otherwise shown on the engineer's detailed wall elevation plan. Set the upper unit and slide it forward until its bottom "groove" is in full contact with the bottom unit's "tongue". Check and adjust level at every course elevation. If shimming is required, use a material such as an asphalt shingle and cover as much of the "low" surface area as possible to achieve the desired result.

Geogrid Placement

When a geosynthetic reinforcement (geogrid) is required, use only the type (or types) specified. Also, make sure the reinforcement is cut to the proper lengths as indicated on the final engineered plan. Most geogrid types are “uni-axial” and must be laid perpendicular to the wall face. Check the manufacturer’s data to insure proper orientation. The geogrid should be laid on the top of the block as near to the front face as possible and extend back over a compacted, level backfill to the length required. Sandwich the reinforcement under the next course of ReCon “Series 50” units to anchor in-place. Pull the grid taut to remove slack or wrinkles. Stake the back of the geogrid prior to placing backfill material to maintain tension. When placing backfill over a layer of geogrid, start just behind the drainage aggregate and fill towards the back of the geogrid. Avoid operating backfill equipment directly on the tensioned geogrid as much as possible. A minimum of 6” of backfill should be placed over the grid prior to the operation of any tracked equipment. Avoid sharp turning and sudden braking with all types of equipment to avoid displacing, wrinkling or damaging the geogrid reinforcement.



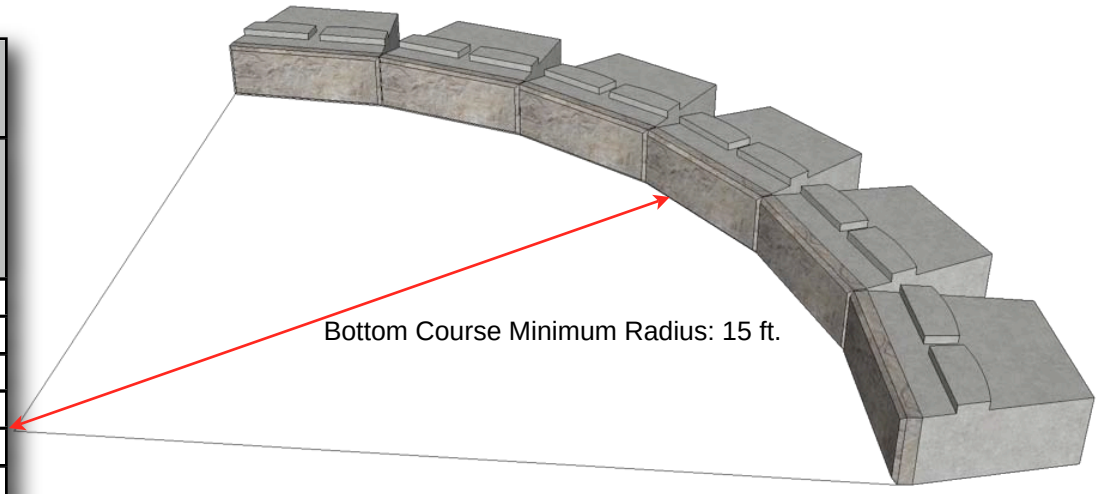
Curved Walls

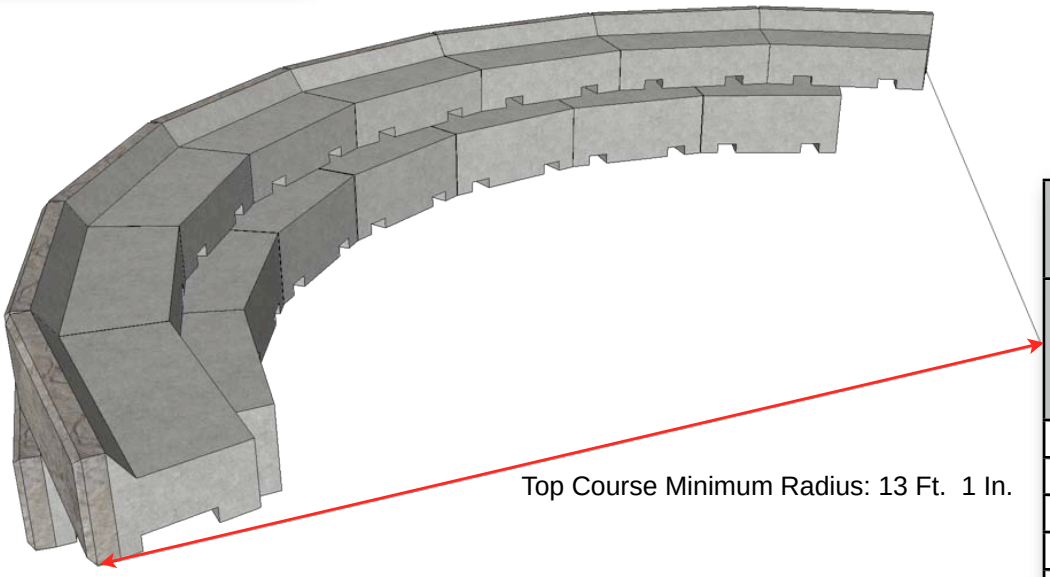
The absolute minimum turning radius for ReCon “Series 50” units is a little over 13’. Due to the integral setback of the units, the actual minimum radius grows or shrinks by 2” or so for each additional course… depending on whether it is an “inside” or “outside” curve in the wall. For ease of installation, it is recommended that the radius at the base row of a multiple row wall be no less than about 15’ at the bottom of an inside radius or top of an outside radius wall. From this starting point, you should add about 2” for each additional course as you plan for your radius wall.

Because ReCon “Series 50” units have a fixed length and a built-in setback, ReCon walls that travel along radiuses will tend to run “off-bond” over long curves and as the height of the wall increases. For wall integrity, it is recommended that whenever a point is reached where there is less than 1/3 of one of the upper units bearing on a unit beneath, a partial unit should be inserted into the wall to return the bond to normal. For aesthetic purposes, try to stagger any partial units placed in the wall so they don’t all occur in the same section along the length of the wall face.

Inside Curve Minimum Radius

Wall Ht.	Number of Courses	Top Row Min. Radius
2’ 8”	2	15’ 2”
4’	3	15’ 4”
5’ 4”	4	15’ 6”
6’ 8”	5	15’ 8”
8’	6	15’ 10”
9’ 4”	7	16’
10’ 8”	8	16’ 2”
12’	9	16’ 4”





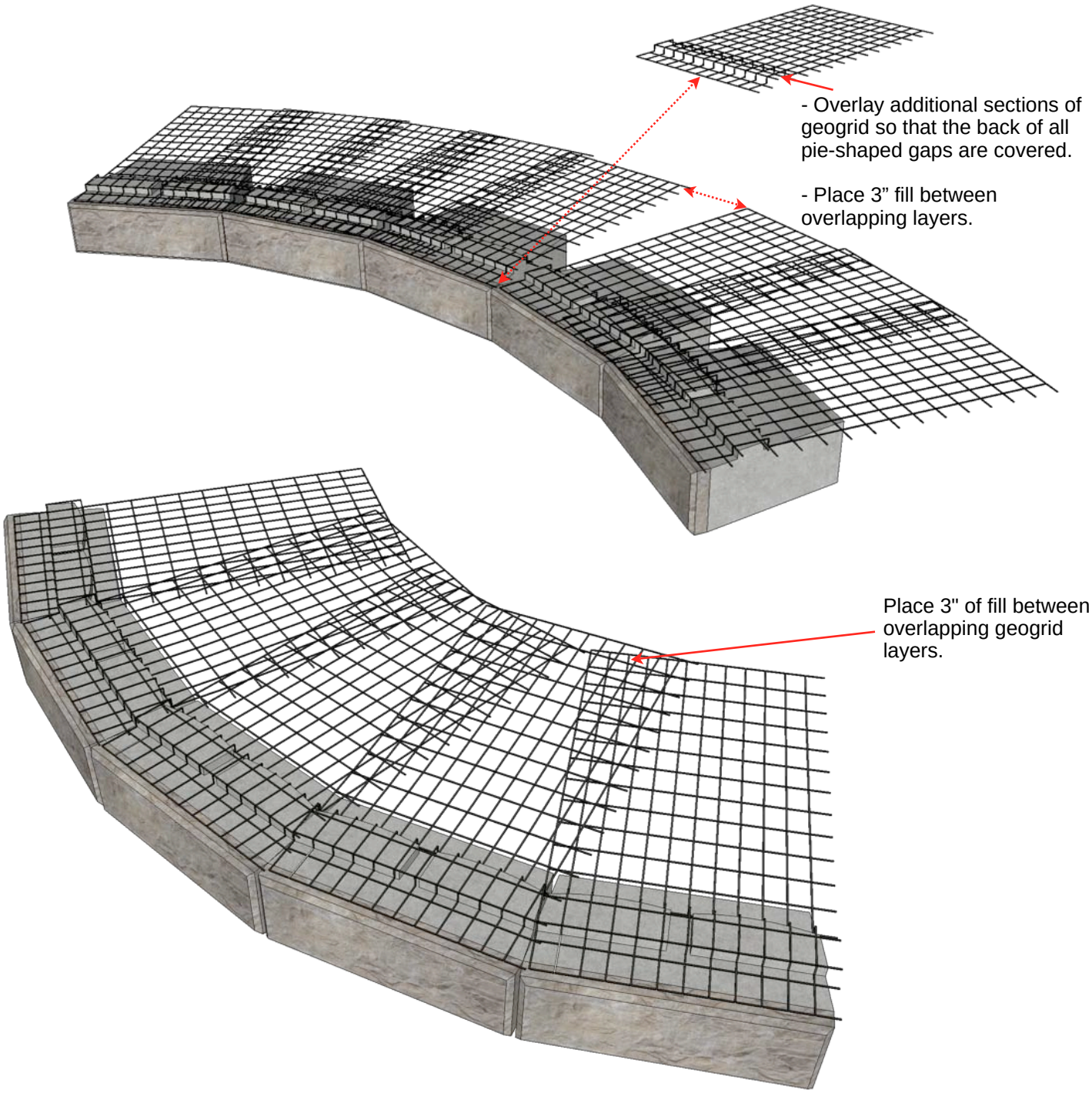
Outside Curve Minimum Radius

Wall Ht.	Number of Courses	Base Row Min. Radius
2’ 8”	2	14’
4’	3	14’ 6”
5’ 4”	4	15’
6’ 8”	5	15’ 6”
8’	6	16’
9’ 4”	7	16’ 6”
10’ 8”	8	17’
12’	9	17’ 6”

Reinforcement Placement on Curved Walls

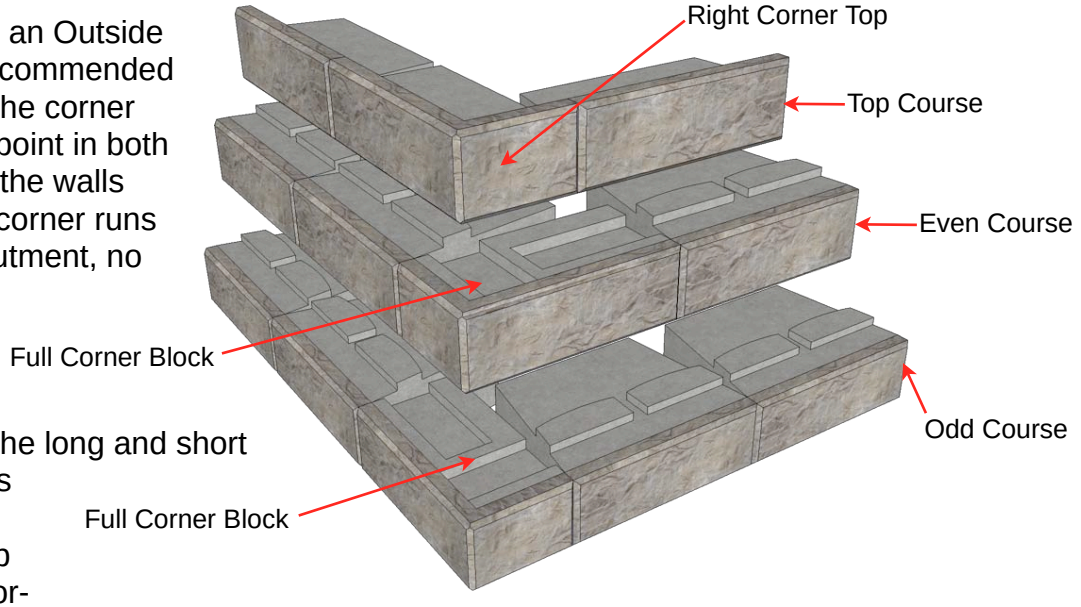
Most accepted design methodologies stipulate that the reinforcement shall be continuous along the length of the wall at both the front and rear of the reinforced soil zone. Geogrid layers should not overlap unless there is compacted soil separating the individual layers. In addition, the natural rectangular sections of geogrid should ***never*** be cut to form a wedge shape.

Rectangular reinforcement sections will naturally overlap in a pie-shaped fashion at either the front or the back of the reinforced zone depending on whether the curve is “inside” or “outside”. The figures show how reinforcement is laid out in this situation. All of the pie-shaped overlap areas should be separated by at least 3” of backfill.



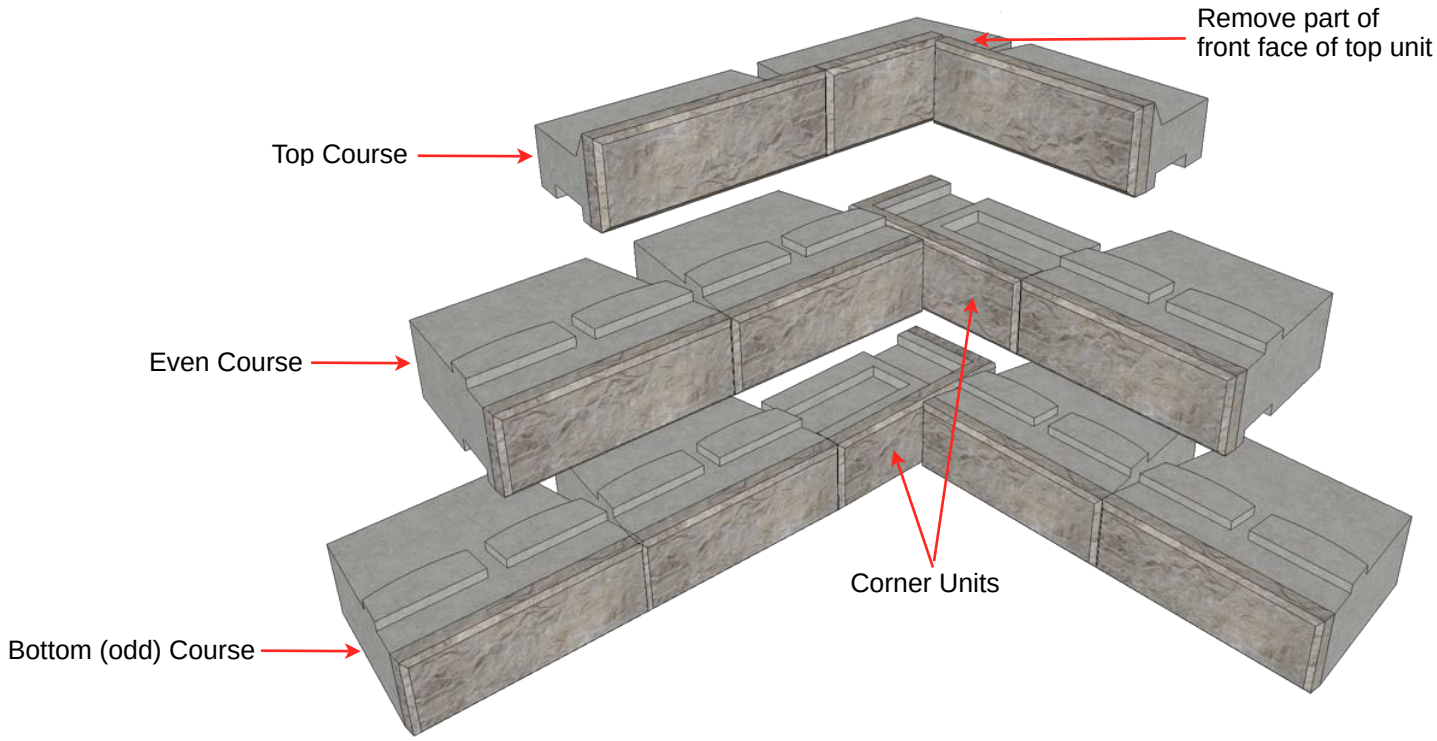
Outside 90 Degree Corners

When building a wall with an Outside 90 Degree Corner, it is recommended that construction start at the corner and work away from this point in both directions. Unless one of the walls going away from the 90° corner runs into another corner or abutment, no block should need to be cut. One standard corner block will be used at the corner on each course, alternating the long and short returns. The corner blocks should be glued at the corner where they overlap with a high-quality, exterior-grade concrete adhesive.



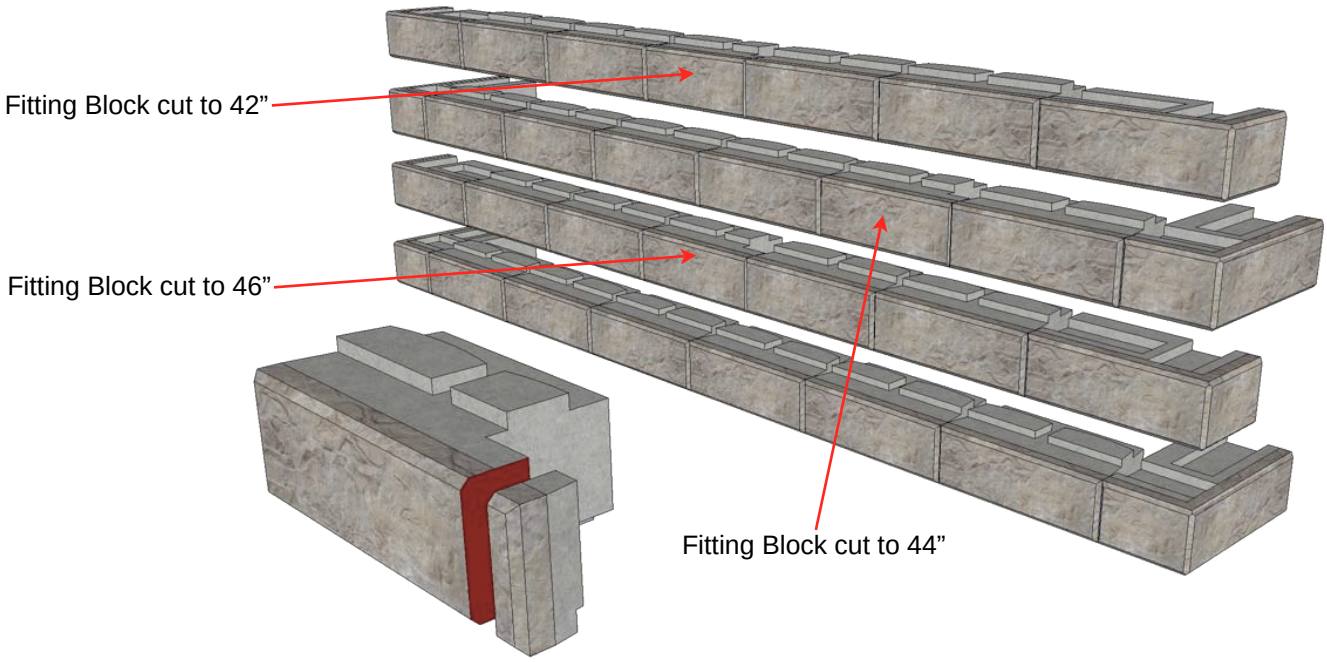
Inside 90 Degree Corners

When building a wall with an Inside 90 Degree Corner, it is recommended that once the base row is laid to the location of the inside corner, subsequent courses should begin at the corner and be laid outward from there. This avoids unnecessary trimming due to the built-in 1” setback. On taller walls, the “running bond joint” will slide off center by 2” for every other row. This does not affect the structural integrity of the wall. One standard corner block will be used at the corner on each row of the wall. The corner blocks will overlap each other at the corner, coming together in an alternating long/short fashion. The corner blocks should be glued at the corner where they overlap with a concrete adhesive.



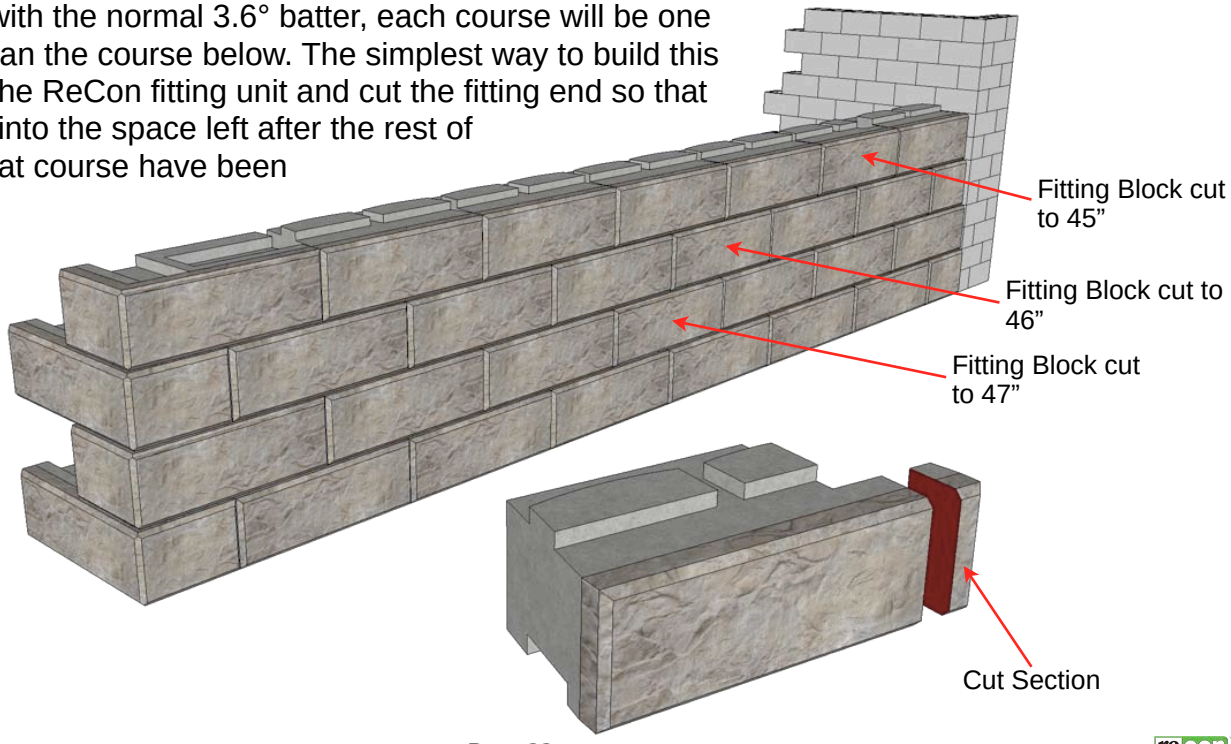
Double Outside 90 Degree Corners

When building a wall with a wall section that is terminated on each end with an Outside 90 Degree Corner, start by placing the corners in their proper location and elevation. Because the wall will narrow by two inches (on a 3.6° battered wall) for each successive course, a partial unit must be cut to fit somewhere along the length of the wall. Use a ReCon fitting unit to create this partial unit, thus making the cutting procedure easier. For aesthetic purposes it is recommended that you locate these partial units at varying locations along the length of the wall.



Outside 90 Degree Corner to Abutment

A ReCon “Series 50” wall may start against an abutment, perhaps a garage or walk-out basement. Often the other end of the wall will turn with a 90° corner. When such a wall is built with the normal 3.6° batter, each course will be one inch shorter than the course below. The simplest way to build this wall is to use the ReCon fitting unit and cut the fitting end so that the unit will fit into the space left after the rest of the units on that course have been laid.



Top of Wall Treatments

ReCon Top Units

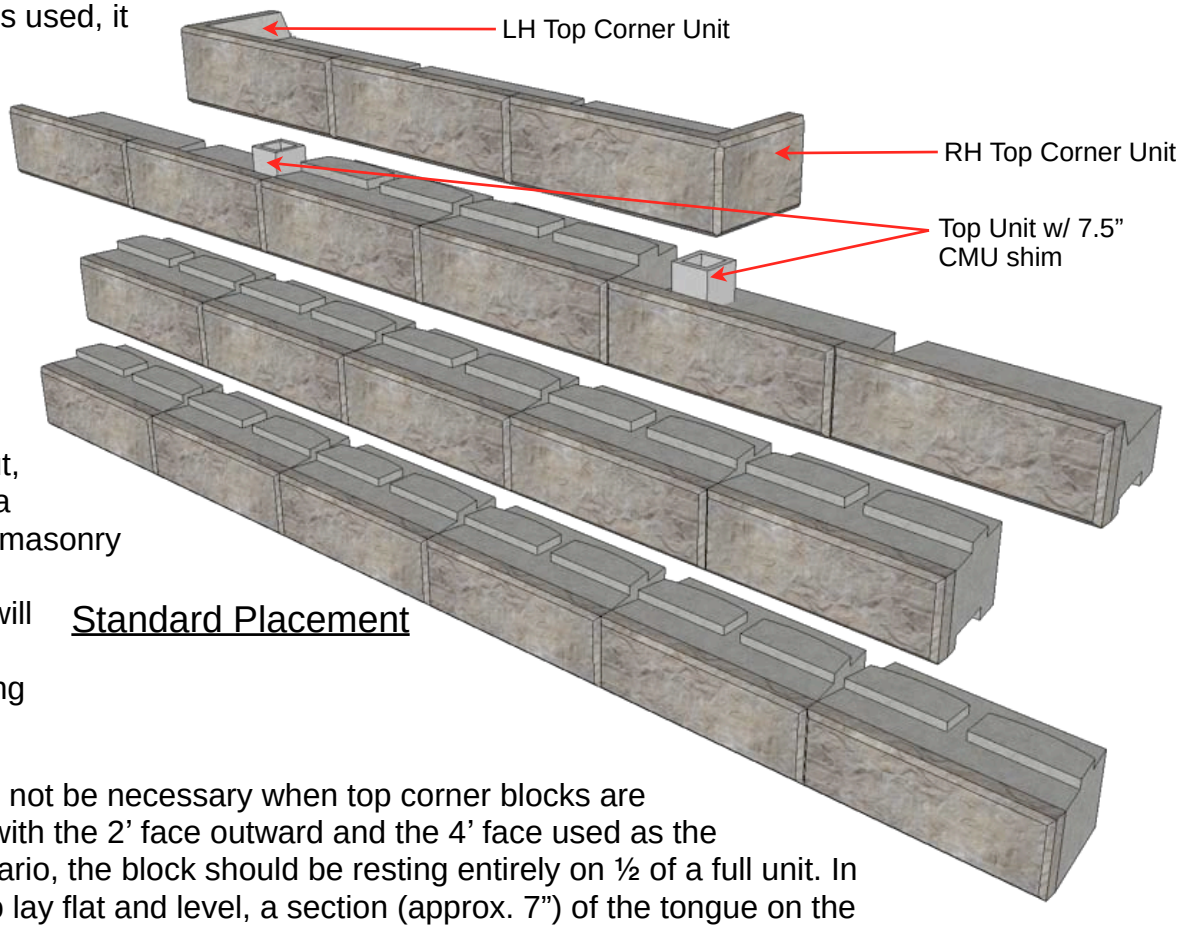
The tops of ReCon walls are usually either capped using ReCon “Series 50” cap units or finished with top block units. Other treatments typically involve special construction, such as forming and pouring a concrete parapet or attaching specialty, precast components.

Capping a wall is a fairly straightforward process. However, radius walls require cutting of the cap units to avoid creating triangular wedges at the front or back of the wall, depending on whether it is an “inside” or “outside” radius.

Using the ReCon “Series 50” top blocks to finish off a wall provides the ability to fill units with a landscape rock or plant material to within 4” of the wall face. When stepping up or down at the top of a wall using top blocks, the “top corner block” is used to make this transition. A top corner block can be laid with either the 2’ or the 4’ face as the return side. Usually the wall layout elevation plan prepared by the design engineer will indicate the proper unit location or type. In the absence of such a plan, the left and right top corner units designate which side the 2’ return dimension is located as you face the finished wall. This is referred to as “standard” placement.

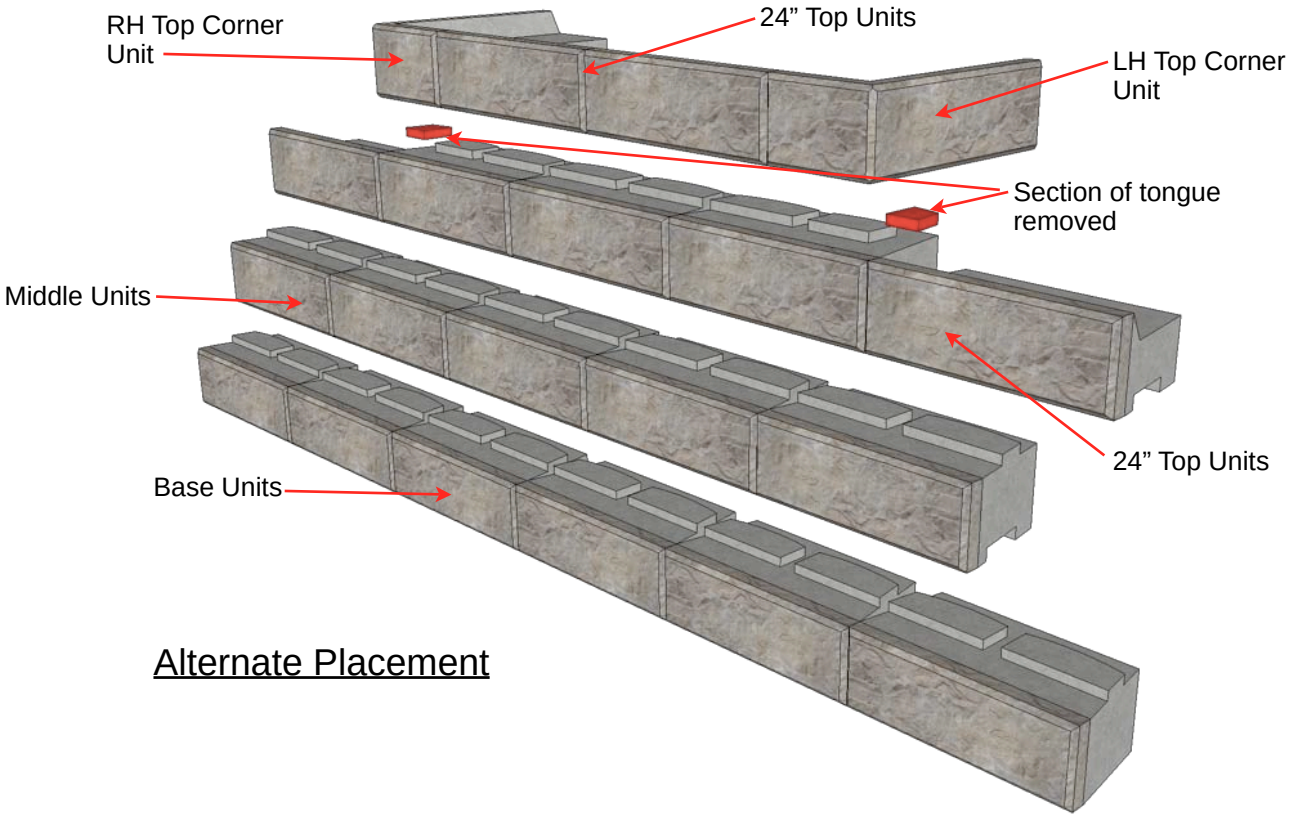
If it is desired that the 4’ face returns back into the retained soil, then a left corner top block will actually return (with respect to the wall face) on its right side and visa-versa for a right corner top block. This is referred to as “alternate” placement.

When the standard placement (4’ face, 2’ return) is used, it will be necessary for block stability to add a concrete shim beneath the portion of the top corner block that bears on part of another top block located beneath. This shim is usually made or cut, if necessary, from a standard concrete masonry unit (CMU). Gluing this shim in place will resist movement during the backfilling process.



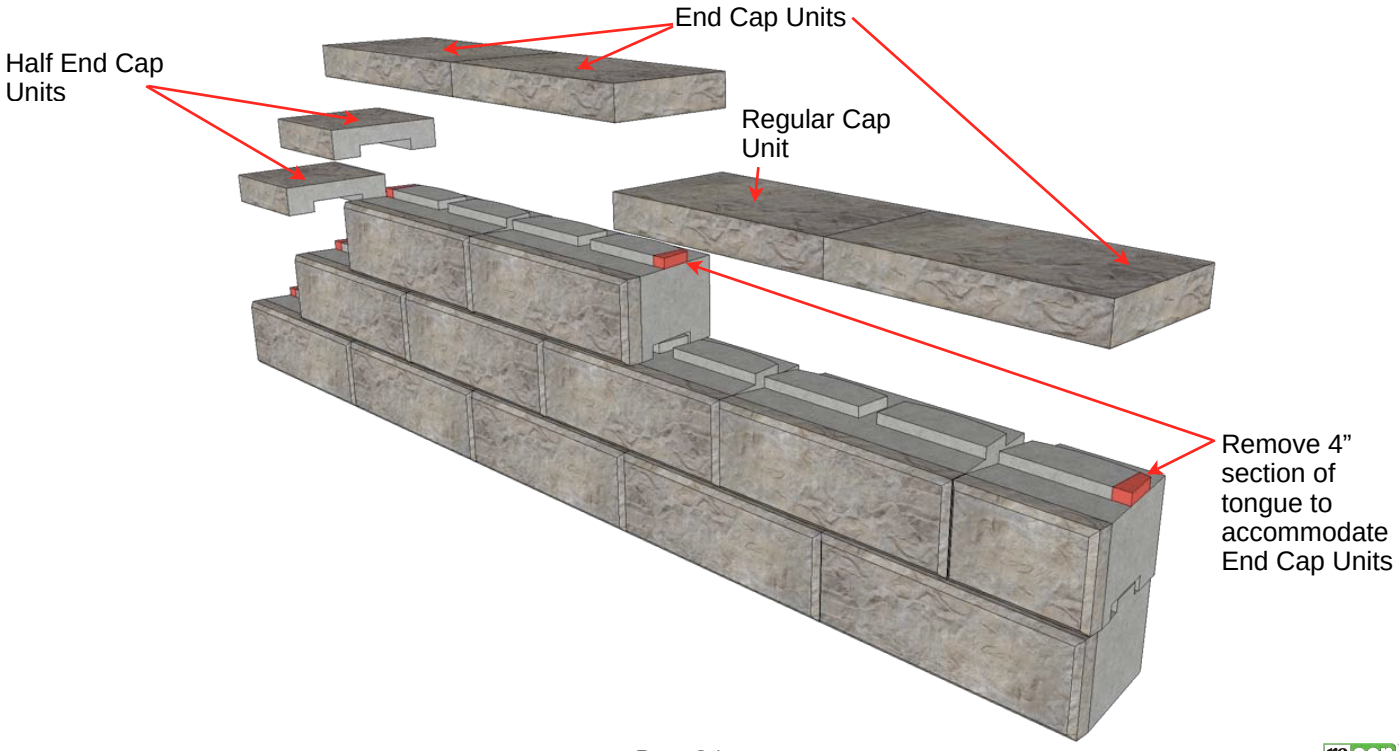
Standard Placement

This procedure will not be necessary when top corner blocks are placed in the wall with the 2’ face outward and the 4’ face used as the return. In this scenario, the block should be resting entirely on ½ of a full unit. In order for the unit to lay flat and level, a section (approx. 7”) of the tongue on the lower unit must be removed.



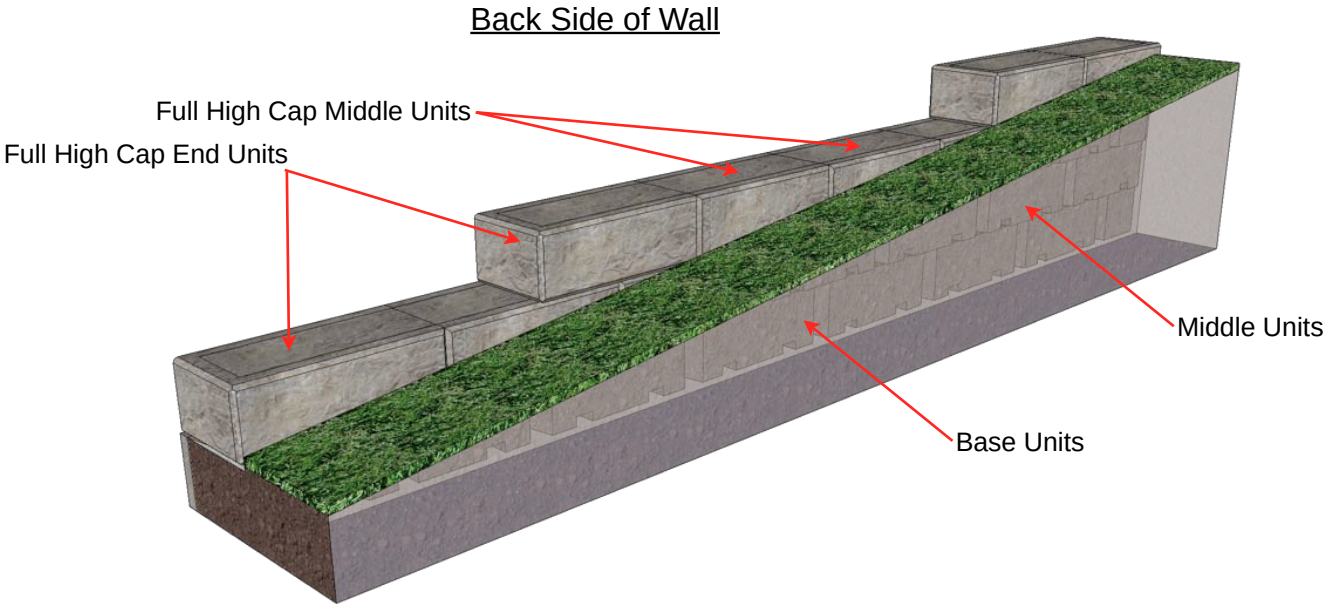
Cap Units

ReCon Cap Units are rectangular in shape and are available in two shapes, a regular cap that has a groove along the entire bottom of the unit and an end cap where the groove terminates 4” from one end to provide a finished appearance on one end. These caps are placed with a scissors clamp and are intended primarily for straight walls. If cap units are to be used atop curved wall sections they will need to be cut to provide a continuous finished appearance.



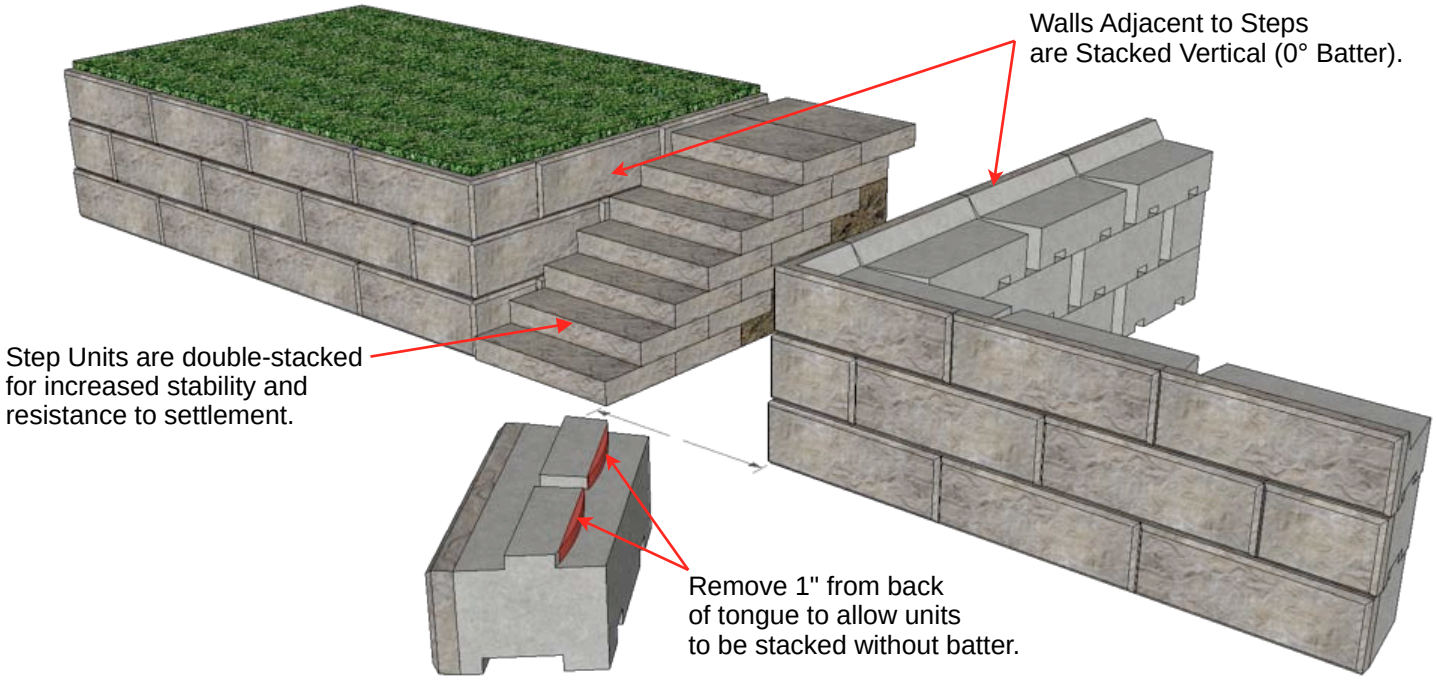
Full-High Cap Units

ReCon Full-High Cap Units can be used when some freeboard above top grade is expected at the top of a wall. This solution can be useful when the wall involves numerous step-ups at the top of the finished wall and a finished appearance is desired for all exposed block above grade.



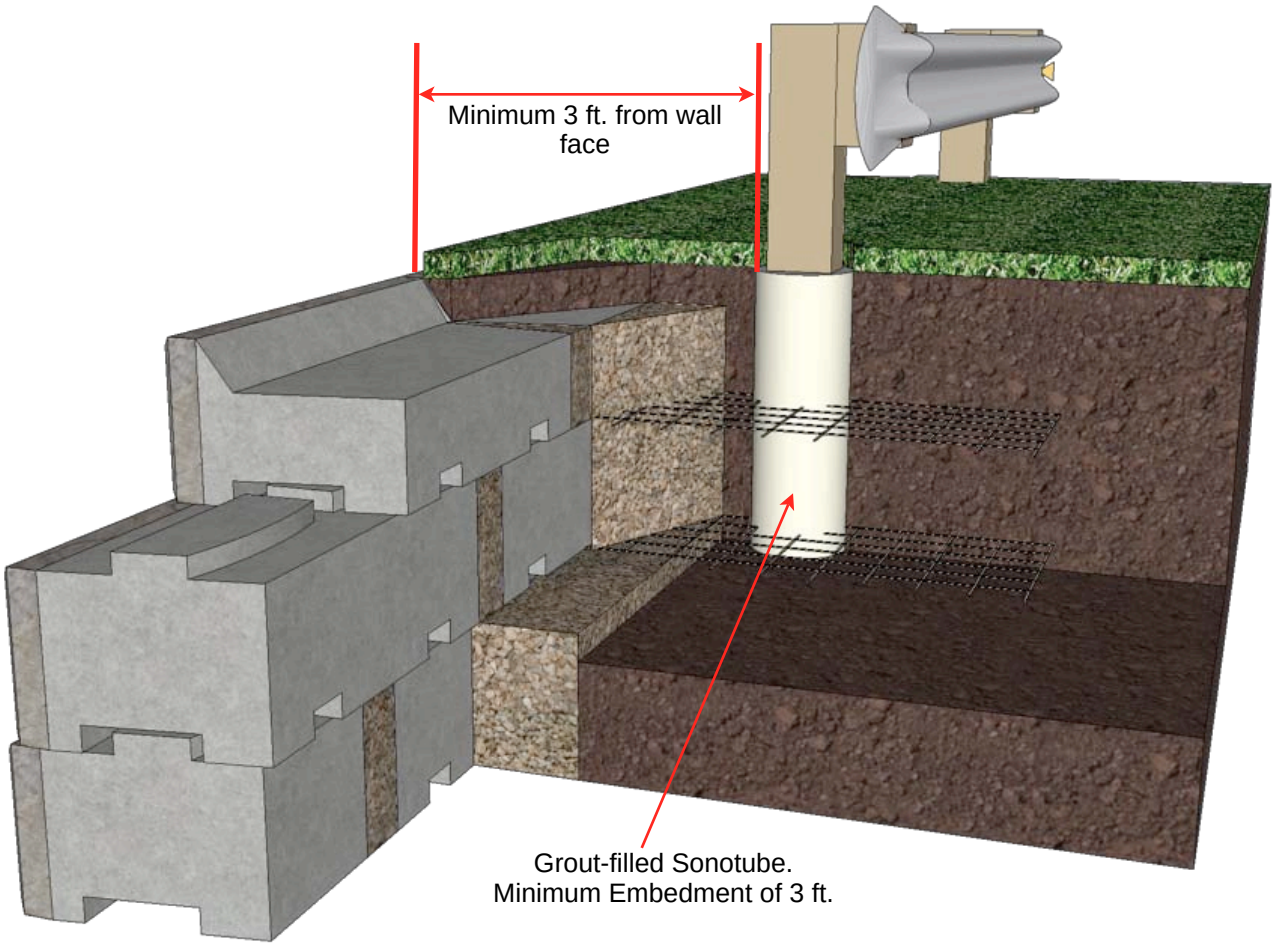
Steps

There are numerous configurations that incorporate steps into a retaining wall. The most common is where the steps begin at the base of the wall and go up through the wall to the top grade. Other step configurations, such as steps protruding from a wall or running parallel up along the wall face can also be designed and would be built using the same general procedures.



Railings and Guardrails

ReCon “Series 50” units can be manufactured to accommodate certain types of fence uprights. It is recommended that a qualified design engineer be consulted to prepare the proper detailing and design of guardrails and / or special critical fencing situations. Local building codes and wind-loading conditions can have a significant effect on the proper and safe design of these features.



Staining and Sealing

The ability to stain and seal a ReCon “Series 50” wall is an attractive benefit to owners and specifiers. When applied by experienced professionals, modern day concrete stains and the realistic stone appearance of the ReCon “Series 50” textures can render a finished ReCon wall nearly indistinguishable from natural stone. Most modern concrete stains have excellent life expectancies. Depending on the environment, walls may not need a reapplication of stain for many years, if at all. An acid-etch stain is, for all practical purposes, permanent. In some situations, weathering may even enhance the appearance of a stained ReCon wall.

Sealing is also an option where it may be necessary to minimize moisture absorption or protect against graffiti. Certain types of stain also provide a degree of sealant protection in addition to adding color and depth.

ReCon recommends that you consult directly with a staining or sealer manufacturer to determine suitability and proper installation procedures for staining and sealing.

ReCon “Series 50” Guide Specification

Note: This guide specification should not be included entirely “as-is”. Specification writers must edit areas in red which may or may not be relevant to a specific project or where mutually exclusive choices are referenced.

SECTION 323223
SEGMENTAL RETAINING WALL

PART 1 GENERAL

1.1. SUMMARY

A. Section Includes: Furnishing materials and labor required for the design and construction of a ReCon “Series 50” concrete segmental retaining wall.

B. Related Sections:
1. Section 312000 Earth Moving
2. Section 099313.13 Exterior Staining
3. Section 099723 Concrete and Masonry Coatings
4. Section 099623 Graffiti-Resistant Coatings

1.2. REFERENCES

A. Concrete Segmental Retaining Wall Units - American Society for Testing and Materials (ASTM)
1. ASTM C-1372 Specification for Segmental Retaining Wall Units (Section 7)
2. ASTM C-94 Standard Specification for Ready Mix Concrete (Table 1 and Section 7)
3. ASTM C-172 Standard Specification for Sampling Freshly Mixed Concrete

B. Drain Pipe - American Society for Testing and Materials (ASTM):
1. ASTM D-3034 Specifications for Polyvinyl Chloride Pipe (PVC)
2. ASTM D-1248 Specifications for Corrugated Plastic Pipe

C. Geo-grid Reinforcements - Geosynthetic Research Institute (GRI) and American Society for Testing and Materials (ASTM):
1. GG1 Geogrid Rib Tensile Strength
2. GG2 Individual Geogrid Junction Strength
3. GG4a Determination of the Long-Term Design Strength of Stiff Geogrids
4. GG4b Determination of the Long-Term Design Strength of Flexible Geogrids
5. ASTM D-4595 Tensile Properties of Geotextiles - Wide Width Strip
6. ASTM D-5262 Unconfined Tension Creep Behavior of Geosynthetics
7. ASTM D-5970 Deterioration of Geotextiles from Outdoor Exposure
8. ASTM D-6706 Measuring Geosynthetic Pullout Resistance in Soil

D. Engineering Design - National Concrete Masonry Association (NCMA):
1. NCMA Design Manual for Segmental Retaining Walls
2. NCMA SRWU-1 Test Method for Determining Connection Strength of SRW
3. NCMA SRWU-2 Test Method for Determining Shear Strength of SRW

E. Soils - American Society for Testing and Materials (ASTM):
1. ASTM D-698 Laboratory Compaction Characteristics of Soil - Standard Effort
2. ASTM D-4318 Liquid Limit, Plastic Limit and Plasticity Index of Soils
3. ASTM D-422 Gradation of Soils
4. ASTM D-424 Atterberg Limits of Soils
5. ASTM D-G51 Soil pH

F. ReCon Construction Detail Drawings: www.reconwalls.com
1. #100 Block Types
2. #101 Typical Base Block Placement
3. #102 Typical Maximum Gravity Wall Heights
4. #103 Typical Geo-Grid Wall Cross Section
5. #104 Typical Geo-Grid Orientation & Curved Walls
6. #105 Typical Inside Radius – Full Block
7. #106 Typical Outside Radius – Full Block
8. #107 Typical Base Row Step Up
9. #108 Typical Top of Wall Step Up
10. #109 Typical Top of Wall Step Up – Alternative Placement
11. #110 Typical Outside Corner Detail
12. #111 Typical Inside Corner Detail
13. #112 Outside Corner Details – Double & Single 90° Corners Abutting to Vertical Structures
14. #113 Typical Guard Rail Detail
15. #114 Typical Fence Detail
16. #115 Typical Water Wall Detail
17. #116 Typical Drain Tile Detail
18. #117 Box Culvert Headwall Grid
19. #118 Box Culvert Headwall Gravity

20. #119 Box Culvert Wing Wall Grid
21. #120 Box Culvert Wing Wall Gravity
22. #121 Oblique Inside Corner Standard
23. #122 Oblique Inside Corner Special
24. #123 Oblique Outside Corner Standard
25. #124 Oblique Outside Corner Special
26. #125 Double Stacked Half Blocks
27. #200 Capstone Unit Details
28. #201 Step Block
29. #301 Full High Cap Block

1.3. DEFINITIONS

A. ReCon Retaining Wall Unit: Concrete, segmental facing block provided by an authorized manufacturer under license to ReCon Retaining Wall Systems, Inc.

B. Geogrid: A geosynthetic material manufactured of high tensile materials specifically for the purpose of reinforcing and creating a structural soil mass.

C. Drainage Aggregate: Clean, crushed rock located within and immediately behind ReCon units to facilitate drainage and avoid compaction in close proximity to ReCon wall units.

D. Reinforced Backfill: Soil zone extending from the Drainage aggregate zone to the back of the embedded geogrid.

E. Foundation Soil: Soil zone immediately beneath the retaining wall facing units, the wall leveling pad and the reinforced soil zone.

F. Retained Soil: Soil immediately behind retaining wall facing and drainage aggregate or reinforced backfill if present.

G. Construction Drawings: Approved final plan for construction prepared and stamped by the wall design engineer licensed to practice in the state where the retaining wall is located.

1.4. SUBMITTALS

A. Contractor shall submit Manufacturer's product data and installation instructions for approval.

B. Contractor shall submit Manufacturer's test reports certifying that the ReCon units manufactured at their production facility meet the requirements of this specification and the requirements of the Construction Drawings.

C. Unless provided within these project documents and/or the project drawings, contractor shall submit two sets of the Construction Drawings for all ReCon retaining walls on the project.
   1. The design must be prepared by a Professional Engineer licensed to practice in the state where the retaining wall is located.
   2. The design shall be per NCMA Design Guidelines for Segmental Retaining Walls, or the AASHTO Standard Specifications for Highway Bridges, whichever is applicable as determined by the retaining wall design engineer.
   3. Construction Drawings shall include:
      a. The retaining wall layout and retaining wall heights.
      b. Proper placement, lengths and types of geogrid reinforcement where necessary.
      c. Typical wall sections.
      d. Types, locations and properties of all drainage materials, appurtenances and special installation requirements not covered in this specification.
      e. Retaining wall elevation views.
      f. Any soils reports or testing conducted in addition to that included within the project drawings and specifications.
      g. Design assumptions.

D. If geogrid reinforcement is required in the final engineered construction drawings, submit manufacturer's product literature, product testing reports and a twelve by twelve inch or larger sample of each type to be used in wall construction.
   1. Testing reports shall include:
      a. Connection strength data for each combination of ReCon segmental unit and geogrid used as determined by NCMA SRWU-1.
      b. Long-term design strength as determined by GG4-91.
      c. Geogrid soil pullout as determined by ASTM D-6706.

E. Submit gradation reports for aggregates used for the wall leveling pad, unit / drainage fill and for select reinforced fill if required in the final engineered wall design.

F. All submittals must be provided and reviewed prior to the start of retaining wall construction.

1.5. DELIVERY, STORAGE, AND HANDLING

A. Contractor shall inspect all products at delivery to determine that the proper materials have been delivered and are useable. Damaged material shall not be incorporated into the work.

B. ReCon retaining wall units shall be stored in a location and manner that protects against excessive weathering and damage.

C. Contractor shall prevent ReCon units from excessive soiling and coming in contact with substances which may stain or adhere to the finished visual surfaces of the unit.

D. Faces of the ReCon shall be free of excessive chipping, cracking and stains.

1.6. QUALITY ASSURANCE

A. Installer Qualifications: Contractor shall have successfully installed at least three projects similar to that of this project within the last two years. Contractor shall maintain at least one mechanic on site at all times that worked on one or more of these previous installations.

B. Owner shall employ the services of an independent geotechnical or materials engineering firm to provide soil testing and quality assurance inspection for wall construction and soils work. Contractor shall provide any quality control testing or inspection not provided by the Owner

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Only licensed and authorized manufacturers of:

1. ReCon Wall Systems, Inc.
   7600 West 27th Street, Suite 229
   St. Louis Park, MN 55426
   (952) 922-0027 Phone
   (952) 922-0028 Fax
   www.reconwalls.com

CONCRETE NEEDS TO MEET THE REQUIREMENTS OF SECTION 540

2.2. MATERIALS

A. ReCon "Series 50" retaining wall units.
   1. The block unit shall consist of concrete with average 28-day compressive strength of no less than 4000 PSI.
   2. Concrete shall have air entrainment by volume (as measured in the plastic state in accordance with ASTM C172) of:
      a. 5.5 - 8.5 percent, or
      b. in conformity with ASTM C94 (Table 1 and Section 7), latest revision.
   3. Exterior dimension at the face shall be 48" by 16" for full and corner unit, and 24" by 16" for half unit.
   4. Depth of unit should be as per Construction Drawings and is available in 24", 39", 45" or 60" depths.
   5. ReCon units used shall maintain tolerances of:
      a. Height: +/- 3/16"
      b. Width: +/- 1/2" unless field cut for fitting purposes.
      c. Depth: No less than the unit design depth (i.e. 24", 39" , 45", 60", 66", 72", 78" or 84") with the textured face portion of the block considered as 4".
   6. Special shape units should be obtained and used where indicated on the final engineered construction drawings. Reference ReCon Drawing # 100 for overview of standard unit types.
   7. ReCon Unit Face Texture: [Specify choice (or choices) as required. Check local availability]
      a. Shall be "LeSueur County Limestone".
      <or>
      b. Shall be "North Shore Granite".
      <or>
      c. Shall be "Old World".
      <or>
      d. Shall be "Rustic."

B. Geogrid Reinforcement: Geosynthetic reinforcement shall be high tensile geogrid or geotextile manufactured specifically for soil reinforcement applications.
   1. Construction Drawings shall indicate type, strength, locations and lengths of reinforcement used.
   2. The geosynthetic manufacturer shall provide all relevant testing to the wall design engineer for incorporation in the wall design and shall be included in the submittal for the Construction Drawings.
   3. No substitution of geosynthetic shall be allowed that was not evaluated in the Construction Drawings.

C. Base Leveling Pad: The wall base leveling pad material shall consist of a compacted crushed stone base or non-reinforced concrete as indicated in the Construction Drawings.

D. Drainage Aggregate: Drainage aggregate shall consist of clean 1" minus crushed stone or gravel meeting the requirements of the Construction Drawings.

E. Backfill material: All backfill material, borrow or imported, shall meet all requirements of the Construction Drawings.

F. Drainage Pipe: If required in Construction Drawings, drainage pipe shall be perforated or slotted PVC pipe manufactured in accordance with ASTM D-3034 or corrugated HDPE pipe manufactured in accordance with ASTM D-1248. Drainage pipe may also be covered with a geotextile filter fabric.

G. Unit adhesive: Adhesive shall be a premium, construction grade suitable for concrete and exterior applications.

2.3. FINISHES

A. ReCon retaining wall color [Specify choice (or choices) as required]
   1. Finished wall shall be left in natural (as-cast) color.
   <or>

B. Finished retaining wall shall be stained in accordance with Section 099313.13 "Exterior Staining".
   1. Acceptable product stains:
      a. Sherwin Williams H & C SHIELD PLUS CONCRETE STAIN
      b. TK Products TRI-SHEEN PIGMENTED STAIN TK-5272
   2. Color shall match [Define reference or sample to match].
      <or>
   3. Color shall be [Designate existing color]

C. Sealing [Optional, list here and specify in Section 099723 Concrete and Masonry Coatings or 099623 Graffiti-Resistant Coatings]
   1. Acceptable sealers
      a. TK Products TK-290 TRI-SILOXANE OTC
D. Anti-Graffiti [Optional, list here and specify in Section 099723 Concrete and Masonry Coatings or 099623 Graffiti Resistant Coatings]
   1. Acceptable Coating
      a. TK Products 1496 TK Permaclean OTC

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify locations of utilities and existing structures prior to excavation.
B. Examine the Project site and evaluate conditions where the ReCon retaining wall will be constructed. Notify the proper supervising authority in writing of any conditions that may interfere with the proper construction of the ReCon wall or delay completion.
C. Promptly notify the wall design engineer of site conditions which may affect wall performance, soil conditions observed other than those assumed, or other conditions that may require a reevaluation of the wall design.

3.2. EXCAVATION

A. Contractor shall excavate to the lines and grades shown on the construction drawings. The contractor shall be careful not to disturb base beyond the lines indicated.
B. Foundation soil shall be excavated as required for footing or base / leveling pad dimensions shown on the construction drawings, or as directed by the wall engineer.
C. Over-excavated areas shall be filled with suitable base or backfill material and compacted to 95% standard proctor.

3.3. FOUNDATION SOILS PREPARATION

A. Foundation soil shall be evaluated by a Geotechnical Engineer or Owner's Representative to ensure that the bearing soils meet or exceed the design conditions or assumptions.
B. Compact foundation soil zone to 95% standard proctor prior to installing base / leveling pad.

3.4. BASE / LEVELING PAD

A. Base shall be located as indicated on the construction drawings and shall have a minimum thickness of 6 inches. Base materials are to be as specified by the wall engineer (generally crushed stone, 3/4" minus, or similar).
B. Width of the base pad must extend a minimum of 6 inches in front and 6 inches in back of the ReCon Base Block footprint.
C. Base material shall be compacted so as to provide a smooth, hard surface on which to place the first course of units.
D. Compact base material to 95% of standard proctor.
E. Base shall be prepared to ensure full contact of the wall unit with base material. Spacing or gaps between units shall not exceed 1/2".
F. Contractor may elect to substitute a portion of the specified granular base materials with a lean, unreinforced concrete topping.
G. When a reinforced footing is required by the construction drawings, it shall be located below the frost line.

3.5. UNIT INSTALLATION

A. First course of units shall be Base Block units and shall be placed in full contact with the base material.
B. Check units for level from side-to-side, front to back and check to maintain unit batter front-to-back.
C. Place unit faces in contact side to side and avoid any gaps greater than 1/2".
D. Fill and compact fill to grade in front of embedded units prior to compaction behind the wall units.
E. Fill voids between ReCon units with 3/4" clean crushed rock to a distance of one foot behind the unit depth unless otherwise instructed in the Construction Drawings.
F. Sweep and clean the top of each course before setting additional courses.
G. Lay each successive course making sure that the bottom recess is in full contact with the unit locators of the course below. Pull unit forward as far as possible. Backfill and compact soil behind the units.
H. Check and maintain level and wall batter by use of shims when necessary.
I. Follow ReCon recommended procedures to maintain acceptable running bond when constructing curved walls and / or corners. Build in accordance with Construction Drawings or ReCon Construction Detail Drawings.
J. Handle units with proper lifting devices that have been certified for the loads associated with the weights of the units. Avoid applying forces to the lifting loops in excess of the normal force associated with the weight of the unit (i.e. avoid applying "shear forces" or "dynamic loads" from bouncing or swinging of a unit.) If the unit is to be transported over a significant distance in the field, it is recommended that a CABLE be used, NOT A CHAIN. The cable has some "stretch" in it that will absorb some of the dynamic loads.

3.6. GEOGRID INSTALLATION

A. Install geosynthetic reinforcement in accordance with manufacturer's recommendations and the Construction Drawings.
B. Locate geosynthetic reinforcement at elevations and to the lengths shown on the Construction Drawings.
C. Prior to installation of geosynthetic reinforcement, level and compact backfill material to the level of the reinforcement layer.

D. Reinforcement design strength direction must be oriented perpendicular to wall face.

E. Position reinforcement on ReCon units over the tongue and groove and to within 2” of the front exposed face. The next course of units shall be placed such that the geogrid is deformed over the tongue and groove. The next course of units must be slid forward such that the back edge of the groove on this unit is up against the back edge of the tongue on the lower unit with the geogrid pinched between the tongue and groove. Hold in place by installing the next course of units.

F. Remove all wrinkles or folds in reinforcement by pulling taut prior to backfill placement. Secure using soil staples, stakes or hand tension until reinforcement is covered with sufficient fill to maintain tensioned position.

G. Reinforcements shall be continuous throughout the embedment length. Splicing along reinforcement strength direction is not allowed.

H. Position reinforcement sections side-by-side to provide 100% coverage along wall face.

I. Where curved wall sections cause overlap areas in reinforcement, maintain at least 3” of soil between layers where overlap occurs.

3.7. REINFORCED BACKFILL PLACEMENT

A. Wall fill material shall be placed in lifts no greater than 8” in depth and shall be less if necessary to achieve necessary compaction.

B. Compact backfill material to 95% of standard proctor.

C. Only hand-operated compaction equipment shall be used within 3 feet of the back of the ReCon Units.

D. Wherever possible, backfill should be placed beginning at the face of the wall. Backfill shall be placed, spread, and compacted in a manner that minimizes the development of wrinkles, folds or movement of the geogrid.

E. Tracked construction equipment shall not be operated directly on the geogrid. A minimum backfill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.

F. Rubber tired equipment may pass over the geogrid reinforcement at slow speeds, (less than 10 MPH). Avoid sudden braking and sharp turning.

G. At the conclusion of each days work, slope backfill at both the crest and bottom of wall away from wall face to prevent surface drainage from scouring or ponding.

H. During wall construction, the General Contractor shall be responsible for coordination of other project site operations so as to avoid adjacent construction site drainage from affecting wall construction area.

I. Upon completion of wall construction work, the General Contractor shall:
   1. Ensure finished grading directs normal drainage away from the finished wall.
   2. Ensure other trades do not operate heavy equipment or excavate near the wall and reinforced soil zone.

3.8. OTHER CONSTRUCTION DETAILS

A. ReCon provides a number of Construction Detail Drawings (see Section 1.2.F) which can be found on ReCon’s website (www.reconwalls.com) and should be referred to for guidance on wall specific applications.

3.9. SITE TOLERANCES

A. Straight walls
   1. Vertical alignment: +/- 1.5” over any 12 ft. distance and no more than +/- 3” over entire length of wall.

B. Horizontal Alignment Control:
   1. Corners and radius location: +/- 1 foot to theoretical location indicated on the Grading Plan.
   2. Radii: +/- 2 ft. from theoretical lines indicated on the Grading Plan

C. Wall Batter At Completion Of Work: +/- 2 degrees from the design batter and no batter less than 2 degrees.

3.10.FIELD QUALITY CONTROL

A. Contractor shall be responsible for proper installation and quality control of all ReCon wall components and appurtenant materials.

B. Owner shall, at their expense, retain a qualified professional to monitor and perform quality assurance checks of the installer's work.

C. Quality Assurance should include foundation soil inspection, frequent backfill compaction testing, verification of geotechnical design parameters and compliance with Construction Drawings and Project Specifications.

3.11.CLEANING

A. After completion of wall installation, remove construction debris and restore any adjacent finished areas affected by wall construction to their pre-construction state.

B. Wash wall face to remove soiling and stains. Do not use acid or detergents that may “burn” or discolor face.

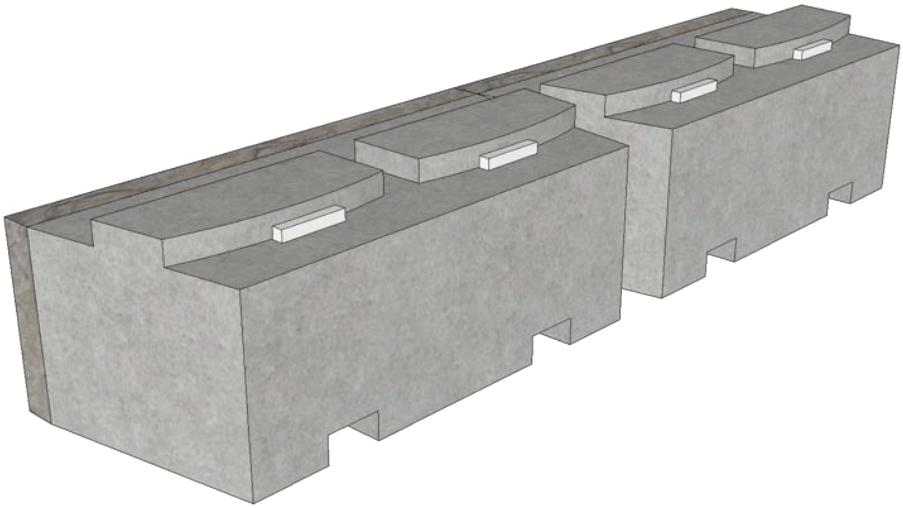
3.12. STAINING / SEALING (Optional)

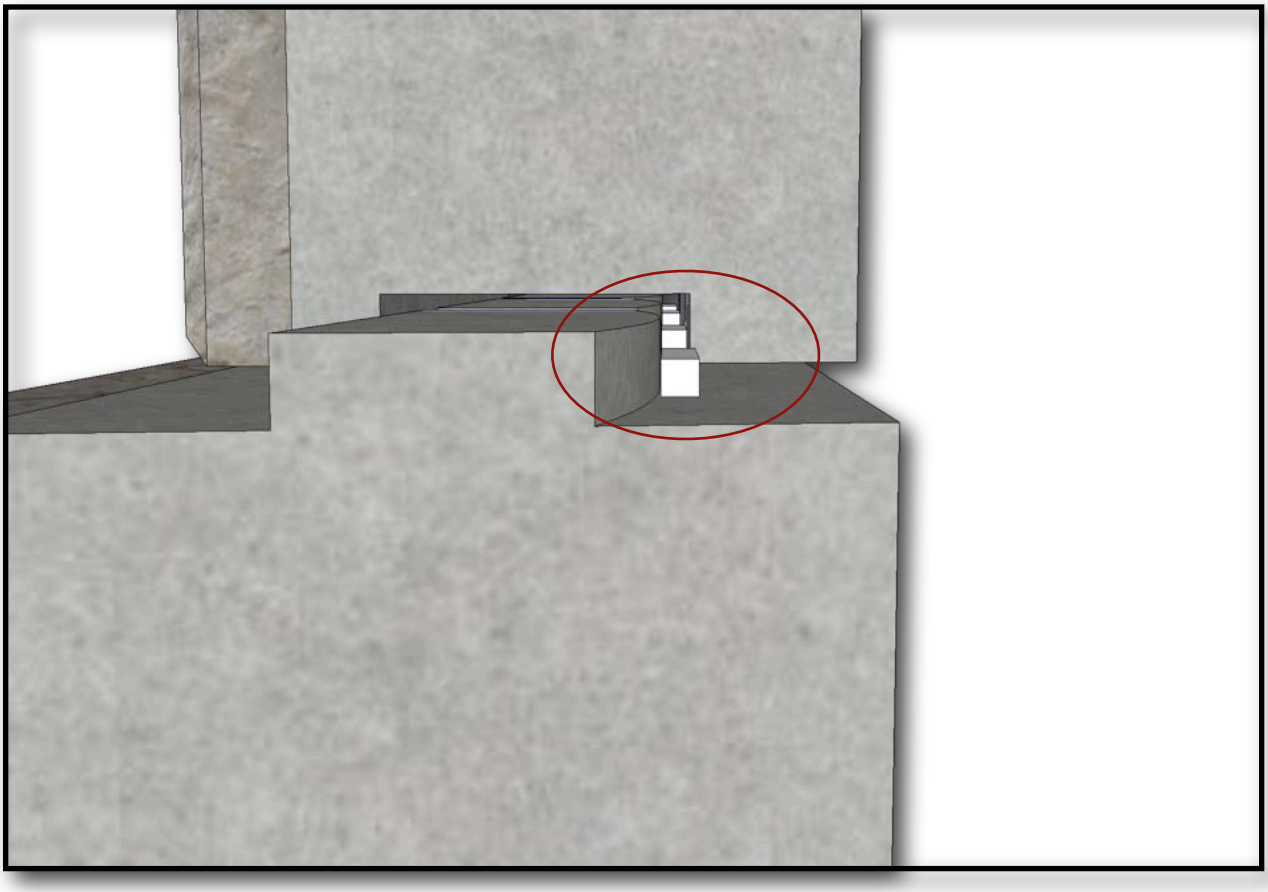
A. Provide samples of stained / sealed faces for approval prior to commencing application to ReCon retaining wall units. Samples shall be large enough to demonstrate scope of color variation.

B. Install stain / sealer in accordance with manufacturers recommended procedures.

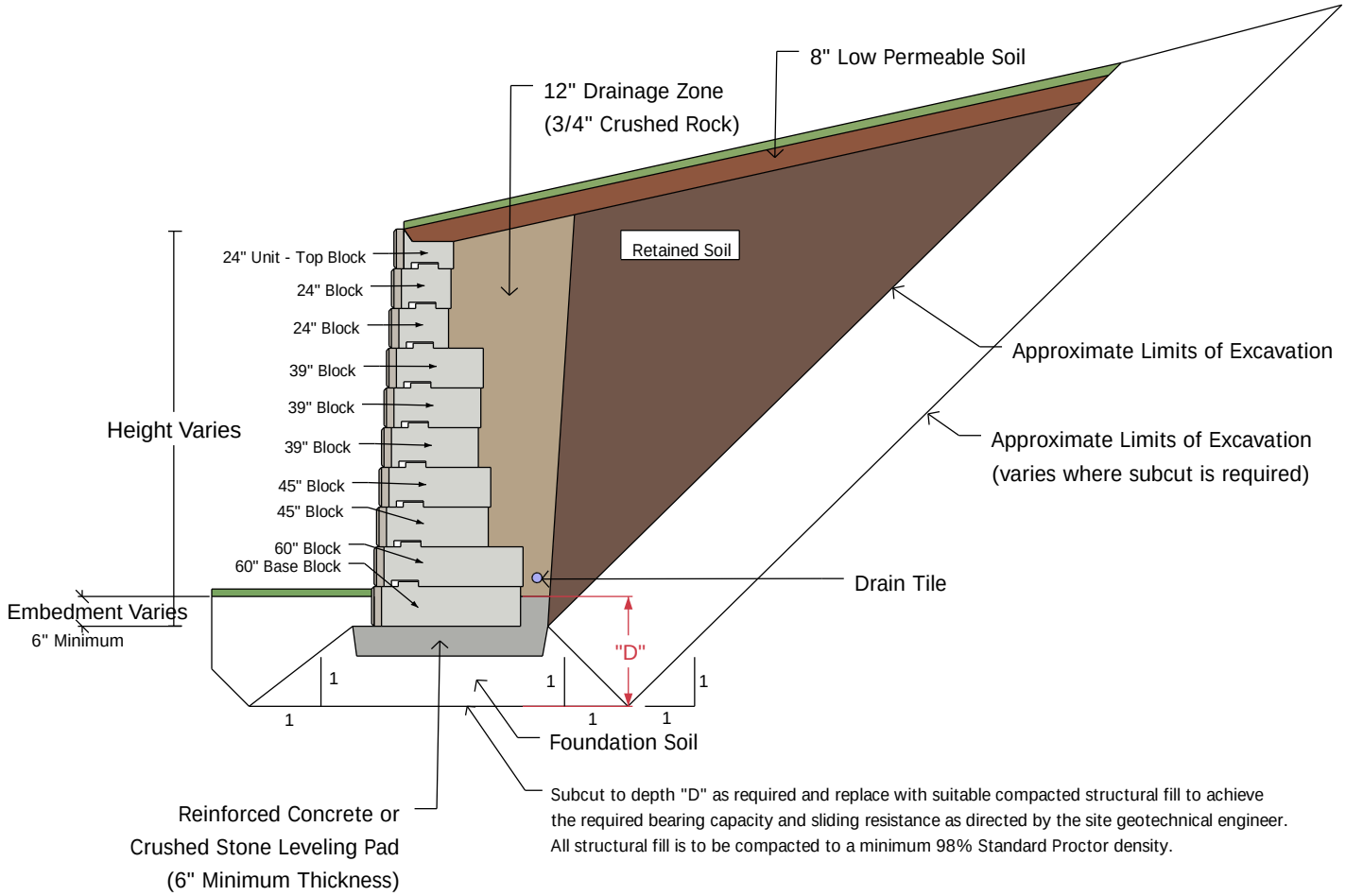
Increasing Gravity Wall Heights

At times a gravity wall may need to be slightly taller than the maximum allowed for the given site conditions. One way to increase the maximum allowed height of a gravity wall is to increase the wall batter, thereby reducing the stresses placed on the wall. ReCon has developed a one-inch fiberglass spacer bar that increases the effective batter of a Series 50 wall to 7.2°. These spacers are placed behind the tongue of a Series 50 unit while the wall is being built. When the next course is laid the spacer bar limits (by one inch) how far forward the unit can be slid forward to make positive contact. The following gravity wall height charts demonstrate the effect of building a wall, or section of wall, using the spacer bars.





Typical Gravity Wall Section



- Wall height is total height from top of wall to top of leveling pad.
- Minimum wall embedment is 6” or 10% of the total wall height, whichever is greater to achieve a level toe slope.
- Leveling pad is crushed stone material.
- Subsurface material must be capable of supporting the wall system.
- Finished grade must provide positive drainage.
- Drainage zone is ¾” crushed stone.
- All backfill materials are compacted to 95% maximum density.

Notes:

1. The gravity wall design charts on the following page are calculated using both the horizontal and vertical components of Coulomb earth pressure.
2. NCMA minimum factors of safety for overturning, sliding and bearing are 1.5, 1.5, and 2.0 respectively. AASHTO minimum factors of safety for overturning, sliding and bearing translate to 2.0, 1.5, and 3.0 respectively. The selection of the appropriate factors of safety should be based on the certainty with which design parameters and the consequences of failure are known. These design charts reflect minimum factors of safety for overturning, sliding and bearing of 1.5, 1.5, and 2.0 respectively.
3. Sliding has been calculated between the base block and the leveling pad. Additional calculations of sliding between the leveling pad and foundation soils should be considered. Global stability has not been addressed in the ReCon Standard Design Chart.
4. The information in the design chart assumes that the soil phi angle is the same for both the foundation and the retained soils.
5. The information in the design chart assumes the soil has a weight of 120 pcf.
6. Installation shall follow ReCon installation instructions and any additional instruction or guidance provided as a part of the final engineered stamped and site specific plans.

Series 50 Standard Design Charts

Gravity Walls

3.6° Batter - 1” Setback per Block Course
7.2° Batter - 2” Setback per Block Course
7.2° Batter requires use of 1” Spacer Bar

Soil Phi Angle: Silt/ Lean Clay 26°	LEVEL BACKSLOPE			250 PSF SURCHARGE†			3H:1V BACKSLOPE††		
Batter		3.6°	7.2°		3.6°	7.2°		3.6°	7.2°
	Wall Height (ft.)	Block Depth (in.)	Block Depth (in.)	Wall Height (ft.)	Block Depth (in.)	Block Depth (in.)	Wall Height (ft.)	Block Depth (in.)	Block Depth (in.)
	1.33	24	24	**1.33**	24	24	**1.33**	24	24
	2.67	24	24	**2.67**	24	24	**2.67**	24	24
	4.00	24	24	**4.00**	24	24	**4.00**	24	24
	5.33	24	24	**5.33**	39	39	**5.33**	39	39
	6.67	39	39	**6.67**	39	39	**6.67**	39	39
	8.00	39	39	**8.00**	45	45	**8.00**	39	39
	9.33	39	39	**9.33**	60	60	**9.33**	60	60
	10.67	45	45	**10.67**	60	60	**10.67**	66	66
	12.00	60	60	**12.00**	66	66	**12.00**	72	72
	13.33	60	60	**13.33**	72	72	**13.33**	84	84
	14.67	66	66	**14.67**	78	78			
	16.00	78	72	**16.00**	84	84			
	17.33	84	78						
	18.67		84						

Soil Phi Angle: Sand/ Gravel 34°	LEVEL BACKSLOPE			250 PSF SURCHARGE†			3H:1V BACKSLOPE††		
Batter		3.6°	7.2°		3.6°	7.2°		3.6°	7.2°
	Wall Height (ft.)	Block Depth (in.)	Block Depth (in.)	Wall Height (ft.)	Block Depth (in.)	Block Depth (in.)	Wall Height (ft.)	Block Depth (in.)	Block Depth (in.)
	1.33	24	24	**1.33**	24	24	**1.33**	24	24
	2.67	24	24	**2.67**	24	24	**2.67**	24	24
	4.00	24	24	**4.00**	24	24	**4.00**	24	24
	5.33	24	24	**5.33**	39	24	**5.33**	24	24
	6.67	24	24	**6.67**	39	39	**6.67**	39	24
	8.00	39	24	**8.00**	39	39	**8.00**	39	39
	9.33	39	39	**9.33**	45	39	**9.33**	39	39
	10.67	39	39	**10.67**	60	60	**10.67**	45	45
	12.00	45	45	**12.00**	60	60	**12.00**	60	60
	13.33	60	60	**13.33**	66	60	**13.33**	60	60
	14.67	60	60	**14.67**	72	72	**14.67**	72	66
	16.00	66	60	**16.00**	78	78	**16.00**	78	72
	17.33	78	66	**17.33**	84	84	**17.33**	84	78
	18.67	84	78	**18.67**		84	**18.67**		84
	20.00		84						

-Foundation soil is assumed to be the same as the retained soil. In some cases, the foundation soil may need to be improved in order to increase sliding resistance between the leveling pad and the foundation soil.

† 250 psf surcharge is offset 3' from the face of the top block
†† 3h:1v backslope is measured from the back of the top block

Disclaimer: These charts were prepared by ReCon Wall Systems, Inc. and to the best of ReCon’s knowledge accurately represents the product use in the application illustrated. This chart is for conceptual, instructional, and estimating purposes only. Anyone making use of this chart does so at their risk and assumes all liability for such use. Final design for construction purposes must be done by a registered professional engineer who is familiar with the product and who has taken into account the specific site conditions. This chart should be read in conjunction with the Notes on page 1.

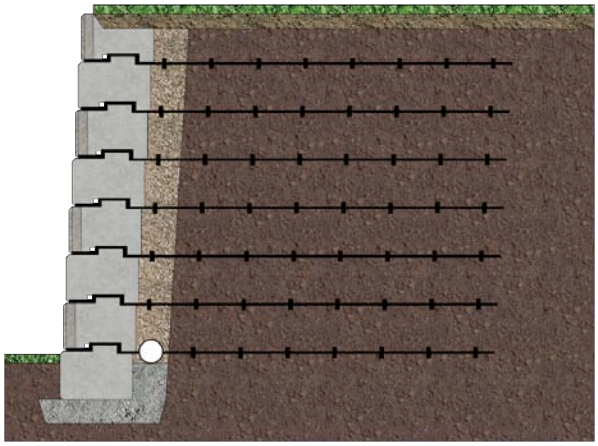
ReCon Series 50 Standard Design Charts

Geogrid Reinforced Walls

- **Assumes an allowable geogrid reinforcement design strength of 1550 lbs. / ft. Check with ReCon for Grid types that have been tested for pull-out connection.**

- **3.6° Batter**
- **No Slope**
- **No Surcharge**

Geogrid Walls			Wall Elevation													
Soil Phi Angle	Wall Height (ft.)		1.33'	2.67'	4.00'	5.33'	6.67'	8.00'	9.33'	10.67'	12.00'	13.33'	14.67'	16.00'	17.33'	18.66'
26°	8.00	Grid Length	8'	n/a	8'	n/a	8'									
	9.33		n/a	9'	n/a	9'	n/a	9'								
	10.66		10'	n/a	10'	n/a	10'	n/a	10'							
	12.00		10'	10'	n/a	10'	n/a	10'	n/a	10'						
	13.33		11'	11'	11'	n/a	11'	n/a	11'	n/a	11'					
	14.66		12'	12'	12'	12'	n/a	12'	n/a	12'	n/a	12'				
	16.00		13'	13'	13'	13'	13'	n/a	13'	n/a	13'	n/a	13'			
	17.33		13'	13'	13'	13'	13'	13'	n/a	13'	n/a	13'	n/a	13'		
	18.66		14'	14'	14'	14'	14'	14'	14'	n/a	14'	n/a	14'	n/a	14'	
	20.00		15'	15'	15'	15'	15'	15'	15'	15'	n/a	15'	n/a	15'	n/a	15'
30°	8.00	Grid Length	7'	n/a	7'	n/a	7'									
	9.33		n/a	8'	n/a	8'	n/a	8'								
	10.66		8'	n/a	8'	n/a	8'	n/a	8'							
	12.00		n/a	9'	n/a	9'	n/a	9'	n/a	9'						
	13.33		10'	n/a	10'	n/a	10'	n/a	10'	n/a	10'					
	14.66		10'	10'	n/a	10'	n/a	10'	n/a	10'	n/a	10'				
	16.00		11'	11'	11'	n/a	11'	n/a	11'	n/a	11'	n/a	11'			
	17.33		12'	12'	12'	12'	n/a	12'	n/a	12'	n/a	12'	n/a	12'		
	18.66		13'	13'	13'	13'	13'	n/a	13'	n/a	13'	n/a	13'	n/a	13'	
	20.00		13'	13'	13'	13'	13'	13'	n/a	13'	n/a	13'	n/a	13'	n/a	13'
34°	8.00	Grid Length	6'	n/a	6'	n/a	6'									
	9.33		n/a	7'	n/a	7'	n/a	7'								
	10.66		8'	n/a	8'	n/a	8'	n/a	8'							
	12.00		n/a	8'	n/a	8'	n/a	8'	n/a	8'						
	13.33		9'	n/a	9'	n/a	9'	n/a	9'	n/a	9'					
	14.66		n/a	9'	n/a	9'	n/a	9'	n/a	9'	n/a	9'				
	16.00		10'	n/a	10'	n/a	10'	n/a	10'	n/a	10'	n/a	10'			
	17.33		n/a	11'	n/a	11'	n/a	11'	n/a	11'	n/a	11'	n/a	11'		
	18.66		12'	n/a	12'	n/a	12'	n/a	12'	n/a	12'	n/a	12'	n/a	12'	
	20.00		12'	12'	n/a	12'	n/a	12'	n/a	12'	n/a	12'	n/a	12'	n/a	12'



Disclaimer: These charts were prepared by ReCon Wall Systems, Inc. and to the best of ReCon's knowledge accurately represent the product use in the application illustrated. This chart is for conceptual, instructional, and estimating purposes only. Anyone making use of this chart does so at their risk and assumes all liability for such use. Final design for construction purposes must be done by a registered professional engineer who is familiar with the product and who has taken into account the specific site conditions.

Notes:
1. Minimum factors of safety for overturning, sliding and bearing are 1.5, 1.5 and 2.0 respectively. Global stability has not been addressed in this chart.
2. The information in the above chart assumes that the soil phi angle is the same for both the foundation and the retained soils.
3. Design as per NCMA standards / Design Manual for Segmental Retaining Walls (2nd Ed) with the exception that the soil pressure is derived using a Rankine Analysis.
4. The information in the above chart assumes that the retained soil has a weight of 120 pcf.
5. Installation shall follow ReCon Installation Instructions and any additional instruction or guidance provided as a part of the final engineered stamped and site specific plans.

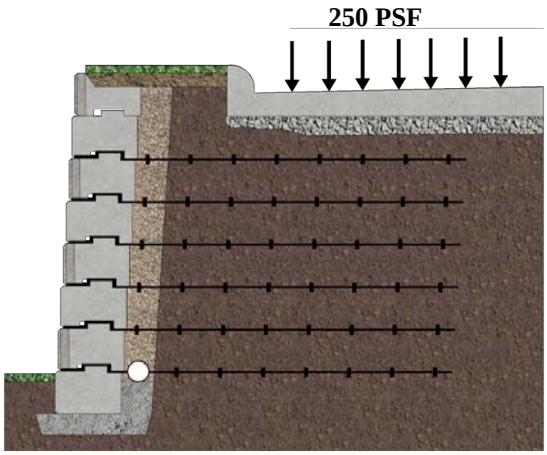
ReCon Series 50 Standard Design Charts

Geogrid Reinforced Walls

- **Assumes an allowable geogrid reinforcement design strength of 1550 lbs. / ft. Check with ReCon for Grid types that have been tested for pull-out connection.**

- **3.6° Batter**
- **250 PSF Surcharge (3' behind wall face)**

Geogrid Walls			Wall Elevation													
Soil Phi Angle	**Wall Height (ft.)**		**1.33'**	**2.67'**	**4.00'**	**5.33'**	**6.67'**	**8.00'**	**9.33'**	**10.67'**	**12.00'**	**13.33'**	**14.67'**	**16.00'**	**17.33'**	**18.66'**
26°	**8.00**	**Grid Length**	10'	n/a	10'	n/a	10'									
	9.33		10'	10'	n/a	10'	n/a	10'								
	10.66		11'	11'	11'	n/a	11'	n/a	11'							
	12.00		12'	12'	12'	12'	n/a	12'	n/a	12'						
	13.33		13'	13'	13'	13'	13'	n/a	13'	n/a	13'					
	14.66		13'	13'	13'	13'	13'	13'	n/a	13'	n/a	13'				
	16.00		14'	14'	14'	14'	14'	14'	14'	n/a	14'	n/a	14'			
	17.33		15'	15'	15'	15'	15'	15'	15'	15'	n/a	15'	n/a	15'		
	18.66		16'	16'	16'	16'	16'	16'	16'	16'	16'	n/a	16'	n/a	16'	
	20.00		17'	17'	17'	17'	17'	17'	17'	17'	17'	17'	n/a	17'	n/a	17'
30°	**8.00**	**Grid Length**	8'	n/a	8'	n/a	8'									
	9.33		n/a	8'	n/a	8'	n/a	8'								
	10.66		9'	n/a	9'	n/a	9'	n/a	9'							
	12.00		10'	10'	n/a	10'	n/a	10'	n/a	10'						
	13.33		11'	11'	11'	n/a	11'	n/a	11'	n/a	11'					
	14.66		11'	11'	11'	11'	n/a	11'	n/a	11'	n/a	11'				
	16.00		12'	12'	12'	12'	12'	n/a	12'	n/a	12'	n/a	12'			
	17.33		13'	13'	13'	13'	13'	13'	n/a	13'	n/a	13'	n/a	13'		
	18.66		13'	13'	13'	13'	13'	13'	13'	n/a	13'	n/a	13'	n/a	13'	
	20.00		14'	14'	14'	14'	14'	14'	14'	14'	n/a	14'	n/a	14'	n/a	14'
34°	**8.00**	**Grid Length**	7'	n/a	7'	n/a	7'									
	9.33		n/a	7'	n/a	7'	n/a	7'								
	10.66		8'	n/a	8'	n/a	8'	n/a	8'							
	12.00		n/a	9'	n/a	9'	n/a	9'	n/a	9'						
	13.33		9'	n/a	9'	n/a	9'	n/a	9'	n/a	9'					
	14.66		n/a	10'	n/a	10'	n/a	10'	n/a	10'	n/a	10'				
	16.00		10'	n/a	10'	n/a	10'	n/a	10'	n/a	10'	n/a	10'			
	17.33		11'	11'	n/a	11'	n/a	11'	n/a	11'	n/a	11'	n/a	11'		
	18.66		12'	12'	12'	n/a	12'	n/a	12'	n/a	12'	n/a	12'	n/a	12'	
	20.00		12'	12'	12'	12'	n/a	12'	n/a	12'	n/a	12'	n/a	12'	n/a	12'



Disclaimer: These charts were prepared by ReCon Wall Systems, Inc. and to the best of ReCon's knowledge accurately represent the product use in the application illustrated. This chart is for conceptual, instructional, and estimating purposes only. Anyone making use of this chart does so at their risk and assumes all liability for such use. Final design for construction purposes must be done by a registered professional engineer who is familiar with the product and who has taken into account the specific site conditions.

Notes:

1. Minimum factors of safety for overturning, sliding and bearing are 1.5, 1.5 and 2.0 respectively. Global stability has not been addressed in this chart.
2. The information in the above chart assumes that the soil phi angle is the same for both the foundation and the retained soils.
3. Design as per NCMA standards / Design Manual for Segmental Retaining Walls (2nd Ed) with the exception that the soil pressure is derived using a Rankine Analysis.
4. The information in the above chart assumes that the retained soil has a weight of 120 pcf.
5. Installation shall follow ReCon Installation Instructions and any additional instruction or guidance provided as a part of the final engineered stamped and site specific plans.

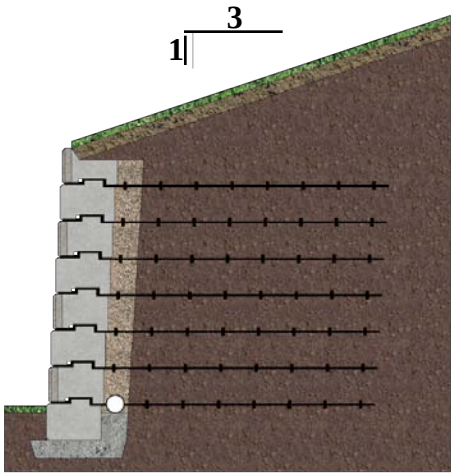
ReCon Series 50 Standard Design Charts

Geogrid Reinforced Walls

- **Assumes an allowable geogrid reinforcement design strength of 1550 lbs. / ft. Check with ReCon for Grid types that have been tested for pull-out connection.**

- **3.6° Batter**
- **3:1 Slope**
- **No Surcharge**

Geogrid Walls			Wall Elevation													
Soil Phi Angle	Wall Height (ft.)		1.33’	2.67’	4.00’	5.33’	6.67’	8.00’	9.33’	10.67’	12.00’	13.33’	14.67’	16.00’	17.33’	18.66’
26°	8.00	Grid Length	7’	n/a	7’	n/a	7’									
	9.33		8'	8'	n/a	8'	n/a	8'								
	10.66		9’	9’	9’	n/a	9’	n/a	9’							
	12.00		11’	11’	11’	11’	n/a	11’	n/a	11’						
	13.33		14’	14’	14’	14’	14’	n/a	14’	n/a	14’					
	14.66		17’	17’	17’	17’	17’	17’	n/a	17’	n/a	17’				
	16.00		20’	20’	20’	20’	20’	20’	20’	n/a	20’	n/a	20’			
	17.33		22'	22'	22'	22'	22'	22'	22'	22'	n/a	22'	n/a	22'		
	18.66		25’	25’	25’	25’	25’	25’	25’	25’	25’	n/a	25’	n/a	25’	
	20.00		27’	27’	27’	27’	27’	27’	27’	27’	27’	27’	n/a	27’	n/a	27’
30°	8.00	Grid Length	6'	n/a	6'	n/a	6'									
	9.33		n/a	7'	n/a	7'	n/a	7'								
	10.66		8'	n/a	8'	n/a	8'	n/a	8'							
	12.00		8'	8'	n/a	8'	n/a	8'	n/a	8'						
	13.33		9'	9'	9'	n/a	9'	n/a	9'	n/a	9'					
	14.66		10’	10’	10’	10’	n/a	10’	n/a	10’	n/a	10’				
	16.00		10’	10’	10’	10’	10’	n/a	10’	n/a	10’	n/a	10’			
	17.33		11’	11’	11’	11’	11’	11’	n/a	11’	n/a	11’	n/a	11’		
	18.66		12’	12’	12’	12’	12’	12’	12’	n/a	12’	n/a	12’	n/a	12’	
	20.00		12’	12’	12’	12’	12’	12’	12’	12’	n/a	12’	n/a	12’	n/a	12’
34°	8.00	Grid Length	6'	n/a	6'	n/a	6'									
	9.33		n/a	6'	n/a	6'	n/a	6'								
	10.66		7'	n/a	7'	n/a	7'	n/a	7'							
	12.00		n/a	8'	n/a	8'	n/a	8'	n/a	8'						
	13.33		8'	n/a	8'	n/a	8'	n/a	8'	n/a	8'					
	14.66		n/a	9'	n/a	9'	n/a	9'	n/a	9'	n/a	9'				
	16.00		10'	n/a	10'	n/a	10'	n/a	10'	n/a	10'	n/a	10'			
	17.33		11'	11'	n/a	11'	n/a	11'	n/a	11'	n/a	11'	n/a	11'		
	18.66		12'	12'	12'	n/a	12’	n/a	12’	n/a	12'	n/a	12’	n/a	12’	
	20.00		12'	12'	12'	12'	n/a	12’	n/a	12’	n/a	12'	n/a	12’	n/a	12’



Disclaimer: These charts were prepared by ReCon Wall Systems, Inc. and to the best of ReCon's knowledge accurately represent the product use in the application illustrated. This chart is for conceptual, instructional, and estimating purposes only. Anyone making use of this chart does so at their risk and assumes all liability for such use. Final design for construction purposes must be done by a registered professional engineer who is familiar with the product and who has taken into account the specific site conditions.

Notes:

1. Minimum factors of safety for overturning, sliding and bearing are 1.5, 1.5 and 2.0 respectively. Global stability has not been addressed in this chart.
2. The information in the above chart assumes that the soil phi angle is the same for both the foundation and the retained soils.
3. Design as per NCMA standards / Design Manual for Segmental Retaining Walls (2nd Ed) with the exception that the soil pressure is derived using a Rankine Analysis.
4. The information in the above chart assumes that the retained soil has a weight of 120 pcf.
5. Installation shall follow ReCon Installation Instructions and any additional instruction or guidance provided as a part of the final engineered stamped and site specific plans.

Warranty

Each Block will have a 28 day compressive strength of at least 4000 PSI for 15 years after proper installation. If a Block does not meet this warranty standard, please notify the manufacturer in writing. If after it has been determined that the Block has not met the specifications, the manufacturer will have shipped to you, replacement Blocks which shall be the manufacturer's sole remedy for breach of this warranty. However, neither the manufacturer nor ReCon Wall Systems, Inc. shall have any obligation to install such replacement Blocks.

This warranty shall not apply to any Block which is damaged, defective or fails to meet the warranty standard due to improper installation of the Block, chemical contact, structural design of the wall, or excessive and unforeseen site conditions beyond the manufacturer's or ReCon Wall Systems, Inc.'s control.

The above warranty is the exclusive limited product warranty. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE DISCLAIMED.

Retaining Wall Systems™

ReCon Wall Systems, Inc.
7600 West 27th Street
Suite 229
St. Louis Park, MN 55426

(952) 922-0027
(952) 922-0028 (Fax Line)
sales@reconwalls.com
www.reconwalls.com

Distributed By:

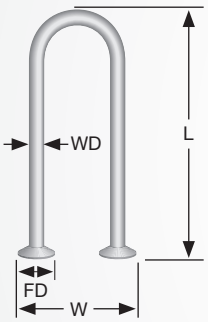
SD Ireland COMPANIES
P O Box 2286 S Burlington VT 05407
193 Industrial Ave Williston VT 05495
P 802-658-0201 F 802-658-6869

2nd Revision - October 2011

Patterson **3/8” x 7” R-ANCHOR**

FOR
RECON™
BLOCKS

Fits in **Standard ReCon Steel Recess Member**

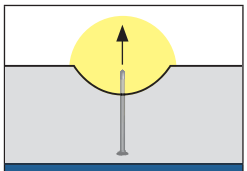


3/8” x 7” R-ANCHOR

Product Code	WD Wire Diameter	L Length	W Width	FD Foot Diameter	Ultimate Mechanical Tensile Capacity (lbs)
LRA387G	3/8”	7”	3-1/4”	1”	18,760

Stripping

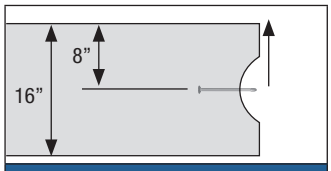
ALLOWABLE LOAD ZONE



Safe Working Load 1,500 PSI Concrete 4:1 SWL (lbs)
4,650

Laying Down Block

ALLOWABLE LOAD ZONE

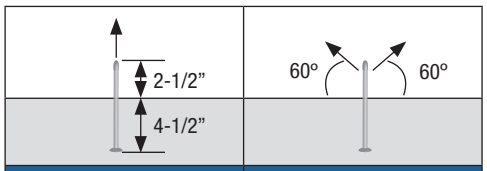


Safe Working Load 1,500 PSI Concrete 4:1 SWL (lbs)
2,195*

* NOTE: When laying down block only 1/2 of the weight of the block is applied to the anchor.

Setting

ALLOWABLE LOAD ZONE



Safe Working Load 1,500 PSI Concrete 4:1 SWL (lbs)	Safe Working Load 1,500 PSI Concrete 4:1 SWL (lbs)
3,455	4,115

BUY ONLINE!

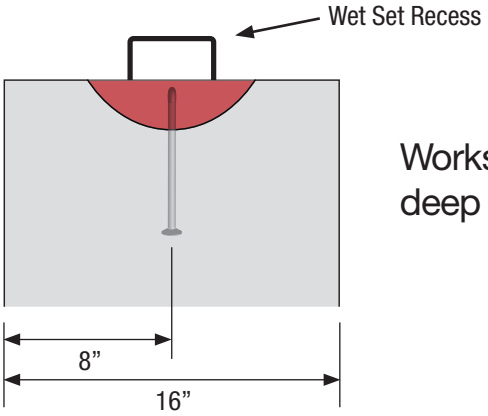
www.patterson-online.com

(800) 332-7090

PATTERSON
Your Single Source Supplier

Installation of **R-Anchor** for **ReCon Blocks**

STRIPPING ANCHOR

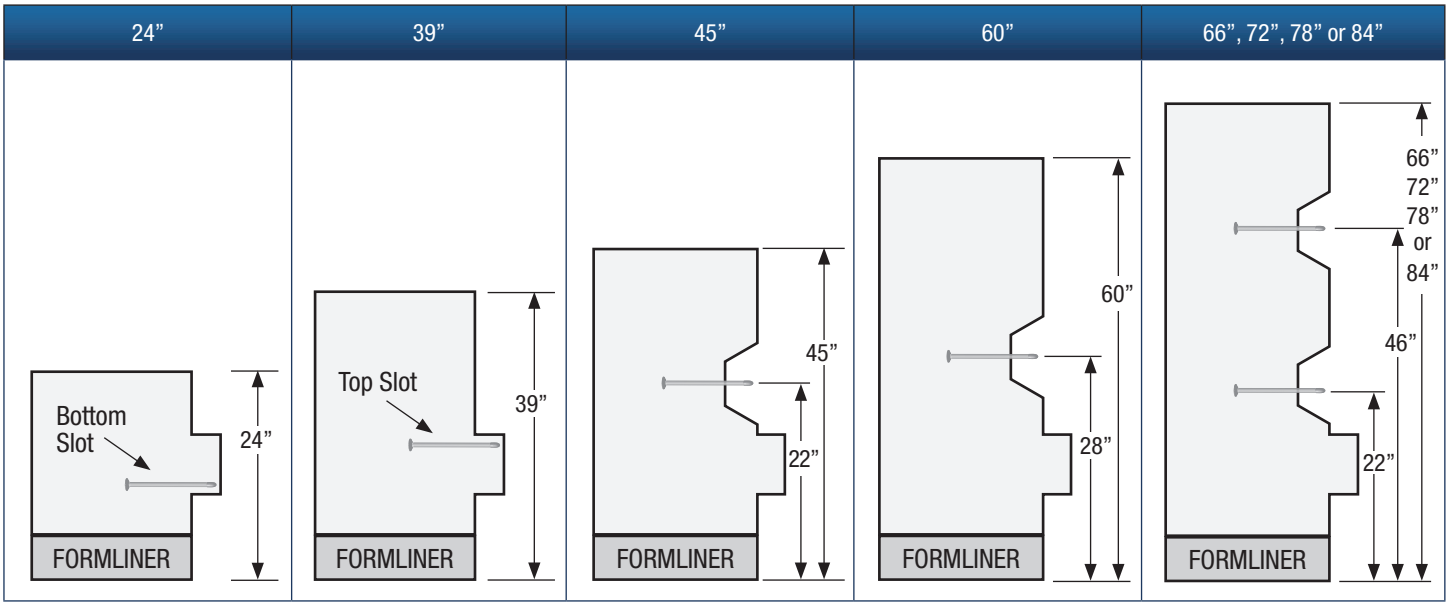


Side View

Works on 24”-84” deep ReCon Blocks

SETTING ANCHOR

BLOCK DEPTH



BUY ONLINE!

www.patterson-online.com

(800) 332-7090

PATTERSON
Your Single Source Supplier

A.L. Patterson, Inc. | 300 Ben Fairless Drive | Fairless Hills, PA 19030 | P: (800) 332-7090 | P: (215) 736-2030 | F: (215) 736-2652 | www.patterson-online.com

VAOT EARTH RETAINING SYSTEM SELECTION CHART

General Classification	Approved Systems	Comments
A. Fill Walls (1,2)		
1. Rigid Gravity and Semi-Gravity Walls	➔ Cast-in-place (CIP) Concrete Gravity Wall	•10 ft. max. height •Settlement sensitive •May require deep foundation
	➔ CIP Concrete Cantilever/ Counterfort Wall	•Settlement sensitive •30 ft. max. height (cantilever) •60 ft. max. height (counterfort) •May require deep foundation
2. Prefabricated Modular Gravity Walls	➔ Modular Crib/Bin Wall -Doublewal® -Stawal® -Timber (VAOT) -Contech® -T-Wall® -Redi-Rock ™* -Recon™	General •35 ft. max. height (except as noted) •Some systems not settlement tolerant •*8 ft. max. height (without geogrid reinforcement)
	-Gabion**	•**25 ft. max. height •**Labor intensive •**Abrasion susceptible •**Need good stone source •**Wire baskets subject to corrosion •**Settlement tolerant
	-Contech Precast Anchored Wingwall System***	•***Approved only for use with Contech Con/Span® Bridge Systems
3. Mechanically Stabilized Earth (MSE) Walls	➔ Segmental, Precast Facing MSE wall -Reinforced Earth® -Retained Earth™ -Tricon™ (under eval.)	•65 ft. max. height •Backfill must meet electrochemical requirements •May Interfere w/underground utilities •Scour susceptible •Minimum base width = 0.7H •Settlement tolerant
	➔ Geotextile/Geogrid/Welded Wire Facing MSE Wall -Tailed Gabions -Redi-Rock ™ with geogrids	•See Gabions •Also suited for temporary conditions