WAITSFIELD BRF 013-4(39)
WAITSFIELD, VERMONT

GENERAL NOTES:

DESIGN PROVISIONS:

1. THE FOLLOWING EFFECTIVE STRENGTH PARAMETERS WERE ASSUMED IN THE PREPARATION OF THE STRUCTURAL CALCULATIONS FOR THE RECON RETAINING WALL SYSTEM:

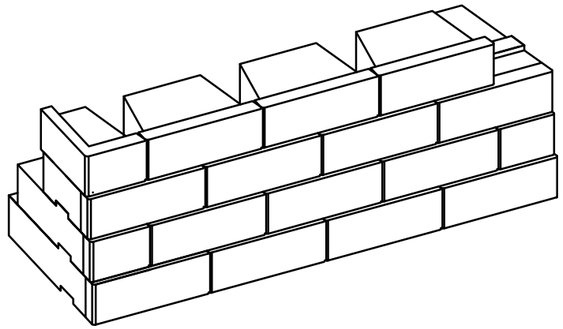
	Φ	c	γ	SOIL TYPE
RETAINED SOIL	34°	0 PSF	140 PCF	SELECT GRANULAR
FOUNDATION SOIL	38°	0 PSF	130 PCF	CLAYEY GRAVEL & SAND

   SOILS INFORMATION OBTAINED FROM THE CONTRACT PLANS PREPARED BY MCFARLAND JOHNSON LAST DATED AUGUST 24, 2015. FOUNDATION SOILS SHALL BE EVALUATED BY A GEOTECHNICAL ENGINEER OR OWNERS REPRESENTATIVE TO ENSURE THAT THE BEARING SOILS MEET OR EXCEED THE DESIGN CONDITIONS OR ASSUMPTIONS.

2. THE WALLS ARE DESIGNED TO MEET THE FOLLOWING DESIGN PARAMETERS AND MAXIMUM SURCHARGE LOADINGS:

UNIT TYPE:	RECON SERIES 50: 24", 39", 60", AND 72" UNITS
FACE TEXTURE:	NORTH SHORE GRANITE
BATTER:	3.6°
DESIGN METHOD:	AASHTO LRFD
LIVE LOAD:	250 PSF
DEAD LOAD:	0 PSF
TOE SLOPE:	2H:1V
BACK SLOPE:	1.5H:1V
SEISMIC:	NONE
HYDROSTATIC:	N/A (DRAINAGE PROVIDED)

3. THE FOUNDATION SOILS AT THE WALL LOCATIONS SHALL BE CAPABLE OF SAFELY SUPPORTING THE MAXIMUM APPLIED BEARING PRESSURE AS SHOWN ON THE WALL PROFILES WITHOUT FAILURE OR EXCESSIVE SETTLEMENT. LOCAL BEARING CAPACITY SHALL BE CONFIRMED BY THE SITE GEOTECHNICAL ENGINEER AFTER FOUNDATION EXCAVATION AND PRIOR TO WALL CONSTRUCTION.



SHEET INDEX

GENERAL NOTES:

SUGGESTED QUALITY ASSURANCE PROVISIONS:

1. MULTIPLE CONTRACTORS (FENCE, WALL, GRADING, ETC.) MAY BE USED TO COMPLETE THE OVERALL PROJECT AS SHOWN ON THESE SHOP DRAWINGS. PLANS DO NOT DEFINE SCOPE OF WORK FOR INDIVIDUAL ENTITIES. SEE CONTRACT DOCUMENTS FOR SPECIFIC DETAILS ON THE SCOPE OF WORK THAT WILL BE PROVIDED BY ALL PARTIES.

2. WALL CONSTRUCTION SHALL BE SUPERVISED BY A QUALIFIED ENGINEER OR TECHNICIAN TO VERIFY FIELD AND SITE SOIL CONDITIONS. IF THIS WORK IS NOT PERFORMED BY THE SITE GEOTECHNICAL ENGINEER, A QUALIFIED GEOTECHNICAL ENGINEER/TECHNICIAN SHALL BE CONSULTED IN THOSE MATTERS PERTAINING TO THE SOIL CONDITIONS AND WALL PERFORMANCE.

3. THE FOUNDATION SOILS AT THE BASE OF THE WALL(S) SHALL BE INSPECTED BY THE GEOTECHNICAL ENGINEER. ANY UNSUITABLE SOILS OR IMPROPERLY COMPACTED EMBANKMENT MATERIAL SHALL BE REMOVED AND REPLACED AS DIRECTED BY THE ENGINEER PRIOR TO WALL CONSTRUCTION TO PROVIDE ADEQUATE BEARING CAPACITY AND MINIMIZE SETTLEMENT.

4. ALL WALL EXCAVATION AND RETAINED SOILS SHALL BE INSPECTED FOR GROUNDWATER CONDITIONS. ANY ADDITIONAL DRAINAGE PROVISIONS REQUIRED IN THE FIELD SHALL BE INCORPORATED INTO THE WALL CONSTRUCTION AS DIRECTED BY THE GEOTECHNICAL ENGINEER.

5. WALL BACKFILL MATERIAL SHALL BE TESTED AND APPROVED BY THE ENGINEER, MEETING THE MINIMUM REQUIREMENTS OF THE APPROVED DESIGN PLANS OR SPECIFICATIONS.

6. ALL SOIL BACKFILL SHALL BE TESTED BY THE GEOTECHNICAL ENGINEER FOR MOISTURE, DENSITY, AND COMPACTION PERIODICALLY (EVERY 2' VERTICALLY, 100'-200' C/C) MEETING THE MINIMUM REQUIREMENTS OF THE APPROVED DESIGN PLANS OR SPECIFICATIONS.

7. THE CONTRACTOR SHALL ESTABLISH AND MAINTAIN QUALITY CONTROL FOR THE CONSTRUCTION OF THE WALL TO ASSURE COMPLIANCE WITH CONTRACT REQUIREMENTS AND MAINTAIN RECORDS OF ITS QUALITY CONTROL.

8. ALL WALL ELEVATIONS, GRADES, AND BACK SLOPE CONDITIONS SHALL BE VERIFIED BY THE ENGINEER IN THE FIELD FOR CONFORMANCE WITH APPROVED DESIGN PLANS. ANY REVISIONS TO THE STRUCTURE GEOMETRY OR DESIGN CRITERIA SHALL REQUIRE DESIGN MODIFICATIONS PRIOR TO PROCEEDING WITH CONSTRUCTION.

_____ Approved
_____ Rejected
_X_ Approved As Noted

This review is only for general conformance with the design concept and the information given in the Construction Documents. Corrections or comments made on the shop drawings during the review do not relieve the Contractor from compliance with the requirements of the Plans and Specifications. Review of a specific item shall not include review of an assembly of which an item is a component. The Contractor is responsible for dimensions to be confirmed and corrected at the job site; information that pertains solely to the fabrication process or to the means, methods, techniques, sequences and procedures of construction; coordination of the Work with that of other trades and performing all Work in a safe and satisfactory manner.

Date 3/22/2016
McFarland Johnson
By D. Kull

Vermont Agency of Transportation
RECEIVED
ON: February 24, 2016
and Checked for
CONFORMANCE
BY: Rob Young DATE: 03/22/2016

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8609 LYNDALE AVENUE SOUTH, SUITE 200 BLOOMINGTON, MN 55420
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SITE SOLUTION PROFESSIONALS, INC. D.B.A. CIVIL DESIGN PROFESSIONALS

No.	Date	Revision	By
1	2.02.2016	REVISE BLOCK AND QUANTITIES	TPH
2			
3			
4			
5			
6			

Designed By: TPH	Project: WAITSFIELD BRF 013-4(39) WAITSFIELD, VERMONT	Registration No: 8619
Scale: N.T.S.		Project No: 15-0789
Date: JAN 28, 2016	Title: TITLE SHEET	Sheet No: 1.00

STATE OF VERMONT
MICHAEL ROBERT JOHNSON
LICENSED PROFESSIONAL ENGINEER

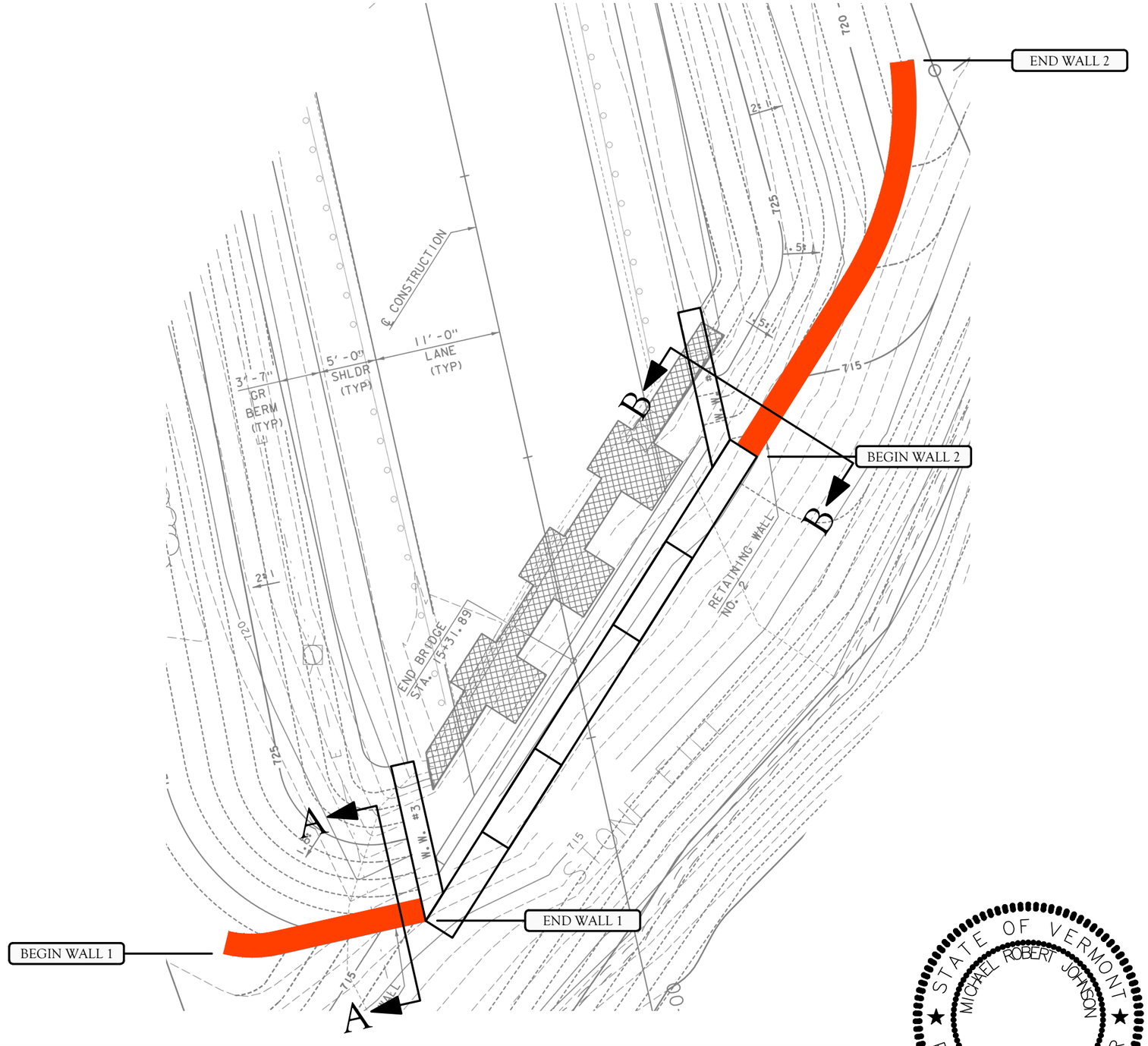
MICHAEL R. JOHNSON, P.E. Date: 2/2/16

NOTES:

1. THE SITE PLAN SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY. SITE PLAN PROVIDED IS REPRODUCED FROM MCFARLAND JOHNSON ABUTMENT NO. 2 GRADING PLAN (SHEET 24 OF 69) LAST DATED AUGUST 24, 2015.
2. THE APPROXIMATE LOCATION OF UTILITIES KNOWN TO EXIST AS SHOWN ON THE PLANS ARE BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF PLAN PREPARATION.
3. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATIONS AND NECESSARY INVERTS OF ALL UTILITIES WITHIN THE LIMITS OF CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE NOTIFICATIONS AND LIAISON WITH UTILITY COMPANIES IN THE PROCESS OF LOCATING, RELOCATING, AND TIE-IN TO THE PUBLIC UTILITIES.

0 10 20 30

GRAPHIC SCALE IN FEET



Know what's **below.** **Call** before you dig.

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No.	Date	Revision	By
1	2.02.2016	REVISE BLOCK AND QUANTITIES	TPH
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3			
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Designed By: TPH	Project: WAITSFIELD BRF 013-4(39) WAITSFIELD, VERMONT		Registration No: 8619
Scale: 1" = 10'			Project No: 15-0789
Date: JAN 28, 2016	Title: SITE PLAN		Sheet No: 2.00

STATE OF VERMONT
MICHAEL ROBERT JOHNSON
LICENSED PROFESSIONAL ENGINEER

MICHAEL R. JOHNSON, P.E. Date: 2/2/16

PART 1: GENERAL

1.01 DESCRIPTION

A. THE WORK TO BE PERFORMED INCLUDES SOURCING, PROVIDING AND INSTALLING CONCRETE RETAINING WALL BLOCKS TO THE LINES AND GRADES AS SPECIFIED ON THE PROJECT CONSTRUCTION DRAWINGS AND AS MAY BE FURTHER SPECIFIED HEREIN.

B. WORK INCLUDES PREPARING FOUNDATION SOIL, FURNISHING AND INSTALLING LEVELING PAD, DRAINAGE AGGREGATE, AND BACKFILL TO THE LINES AND GRADES SHOWN ON THE CONSTRUCTION DRAWINGS.

C. WORK INCLUDES FURNISHING AND INSTALLING ALL RELATED MATERIALS REQUIRED FOR CONSTRUCTION OF THE RETAINING WALL AS SHOWN ON THE CONSTRUCTION SHOP DRAWINGS.

1.02 REFERENCE STANDARDS

A. ASTM D448 SIZES OF AGGREGATE FOR ROAD AND BRIDGE CONSTRUCTION.

B. ASTM D698 LABORATORY COMPACTION CHARACTERISTICS USING STANDARD EFFORT.

C. AASHTO T27 SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES.

D. AASHTO T90 STANDARD METHOD OF TEST FOR DETERMINING THE PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS.

1.03 QUALITY ASSURANCE

A. OWNER SHALL BE RESPONSIBLE FOR SOIL TESTING AND INSPECTION QUALITY CONTROL DURING EARTHWORK OPERATIONS.

E. VTrans Standards Specifications for Construction and Contract Special Provisions

PART 2: MATERIALS

2.01 DEFINITIONS

A. RECON RETAINING WALL UNIT - A PRECAST CONCRETE, SEGMENTAL FACING BLOCK PROVIDED BY AN AUTHORIZED MANUFACTURER UNDER LICENSE TO RECON RETAINING WALL SYSTEMS, INC.

B. BASE LEVELING PAD - AN UNREINFORCED CAST-IN-PLACE OR COMPACTED CRUSHED STONE PAD WHICH SERVES AS A FLAT SURFACE FOR PLACING THE INITIAL COURSE OF PRECAST UNITS.

C. DRAINAGE AGGREGATE - CLEAN 1" ANGULAR CRUSHED ROCK LOCATED WITHIN AND IMMEDIATELY BEHIND THE RETAINING WALL UNITS TO FACILITATE DRAINAGE AND AVOID COMPACTION IN CLOSE PROXIMITY TO THE RETAINING WALL UNITS.

D. FOUNDATION SOIL - SOIL ZONE IMMEDIATELY BENEATH THE RETAINING WALL FACING UNITS AND THE WALL LEVELING PAD.

E. RETAINED SOIL - SOIL IMMEDIATELY BEHIND THE RETAINING WALL FACING DRAINAGE AGGREGATE.

F. SUBSURFACE DRAINAGE SYSTEM - A SYSTEM FOR REMOVING WATER FROM BEHIND THE WALL AND CHANNELING IT TO A POINT OF POSITIVE DRAINAGE.

G. GEOTEXTILE FABRIC - PERMEABLE FABRIC USED IN SUBSURFACE DRAINAGE TO SEPARATE, FILTER, AND PROVIDE PERMANENT EROSION CONTROL.

2.02 RECON RETAINING WALL UNITS

A. RECON WALL UNITS SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI. STANDARD WEIGHT CONCRETE SHALL HAVE A ~~4.5-7.5%~~ AIR ENTRAINMENT BY VOLUME. WEIGHT OF CONCRETE SHALL BE 145 PCF.

B. RECON BLOCKS SHALL BE CONSISTENT AND FREE OF STAINS, DEFECTS, CRACKS, OR CHIPS. UNITS THAT CONTAIN VISIBLE DEFECTS SUCH AS, BUT NOT LIMITED TO, VERTICAL OR HORIZONTAL SEAMS, CONSPICUOUS STAINS, FORM MARKS, OR COLOR STREAKS SHALL BE REPAIRED TO THE SATISFACTION OF THE PROJECT ENGINEER OR REMOVED AND REPLACED AT THE CONTRACTOR'S EXPENSE.

C. TEXTURE ON THE FACE OF THE BLOCK SHALL BE NORTH SHORE GRANITE (NATURAL GREY).

5%-9%

2.03 BASE LEVELING PAD MATERIAL

A. MATERIAL SHALL CONSIST OF UNREINFORCED CONCRETE OR COMPACTED CRUSHED STONE AS SHOWN ON THE CONSTRUCTION DRAWING.

2.04 DRAINAGE AGGREGATE AND CRUSHED STONE RETAINED BACKFILL (PHI 40°)

A. AGGREGATE SHALL HAVE AT LEAST TWO FRACTURED FACES AND SHALL NOT BE RIVER ROCK OR PEA GRAVEL.

B. AGGREGATE SHALL CONSIST OF CLEAN 1" CRUSHED STONE MEETING THE FOLLOWING GRADATION:

SIEVE SIZE	% PASSING
1"	100
3/4"	100 - 75
NO. 4	0 - 10
NO. 50	0 - 5

2.05 RETAINED BACKFILL (PHI 34°)

A. BACKFILL SHALL BE FREE OF DEBRIS AND ORGANIC MATERIAL MEETING THE FOLLOWING GRADATION:

SIEVE SIZE	% PASSING
4"	100
3"	100 - 75
NO. 40	0 - 60
NO. 200	0 - 12

PLASTICITY INDEX (PI)<6

B. SOUNDNESS. THE MATERIAL SHALL BE SUBSTANTIALLY FREE OF SHALE OR OTHER SOFT PARTICLES WITH POOR DURABILITY CHARACTERISTICS. THE MATERIAL SHALL HAVE A SODIUM SULFATE SOUNDNESS LOSS OF LESS THAN 8% AFTER FIVE (5) CYCLES, AS DETERMINED IN ACCORDANCE WITH AASHTO T104.

C. MATERIAL CAN BE SITE EXCAVATED MATERIAL WHEN THE ABOVE REQUIREMENTS ARE MET. UNSUITABLE SOILS FOR BACKFILL (HIGH PLASTIC CLAYS OR ORGANIC MATERIALS) SHALL NOT BE USED IN THE RETAINED SOIL MASS.

D. CONTRACTOR SHALL SUBMIT RETAINED FILL SAMPLE AND TEST RESULTS TO THE ARCHITECT/ENGINEER FOR APPROVAL PRIOR TO CONSTRUCTION.

2.06 SUBSURFACE DRAINAGE SYSTEM

A. SUBSURFACE DRAINAGE SYSTEM SHALL CONSIST OF PERFORATED POLYETHYLENE (PE) PIPE WRAPPED IN A GEOTEXTILE FABRIC OR NON-PERFORATED WHERE REQUIRED.

B. NON-PERFORATED PIPE SHALL BE USED TO CONNECT DRAINS FROM THE WALL TO DRAINAGE STRUCTURES OR HEADWALLS.

C. FITTINGS SHALL BE PER MANUFACTURER'S RECOMMENDATIONS.

2.07 GEOTEXTILE FABRIC

A. GEOTEXTILE FABRIC SHALL BE A NON-WOVEN FABRIC MEETING THE REQUIREMENTS OF SECTION 649 FOR GEOTEXTILE FOR ROADBED SEPARATOR, UNLESS OTHERWISE SPECIFIED.

PART 3: EXECUTION

3.01 EXCAVATION

A. CONTRACTOR SHALL EXCAVATE TO THE LINES AND GRADES SHOWN ON THE CONSTRUCTION DRAWINGS. CONTRACTOR SHALL BE CAREFUL NOT TO DISTURB EMBANKMENT AND FOUNDATION MATERIALS BEYOND LINES SHOWN.

3.02 FOUNDATION SOIL PREPARATION

A. FOUNDATION SOIL SHALL BE EXCAVATED AS REQUIRED FOR LEVELING PAD DIMENSIONS SHOWN ON THE CONSTRUCTION DRAWINGS, OR AS DIRECTED BY THE GEOTECHNICAL ENGINEER.

B. UNSUITABLE SOILS SHALL BE REMOVED AND REPLACED WITH ACCEPTABLE MATERIAL.

C. OVER-EXCAVATED AREAS SHALL BE BACKFILLED WITH APPROVED COMPACTED BACKFILL MATERIAL.

3.03 BASE LEVELING PAD

A. LEVELING PAD MATERIALS SHALL BE PLACED UPON APPROVED FOUNDATION AS SHOWN ON THE CONSTRUCTION DRAWINGS TO A MINIMUM THICKNESS OF 6".

B. AGGREGATE MATERIAL SHALL BE COMPACTED TO PROVIDE A DENSE, LEVEL SURFACE ON WHICH TO PLACE THE FIRST COURSE OF MODULAR UNITS. COMPACTION SHALL BE TO 95% OF STANDARD PROCTOR DENSITY AS DETERMINED IN ACCORDANCE WITH ASTM D698.

C. CRUSHED STONE SHALL BE PLACED IN MAXIMUM 6" LIFTS AND SHALL BE WELL COMPACTED WITH A VIBRATORY PLATE COMPACTOR OR OTHER SUITABLE EQUIPMENT.

3.04 UNIT INSTALLATION

A. THE FIRST COURSE OF CONCRETE MODULAR WALL UNITS SHALL BE CAREFULLY PLACED ON THE BASE LEVELING PAD. EACH UNIT SHALL BE CHECKED FOR LEVEL AND ALIGNMENT.

B. UNITS ARE PLACED SIDE BY SIDE FOR FULL LENGTH OF WALL ALIGNMENT. ALIGNMENT MAY BE DONE BY MEANS OF A STRING LINE OR OFFSET FROM A BASE LINE.

C. SWEEP EXCESS MATERIAL FROM TOP OF UNITS AND INSTALL NEXT COURSE. ENSURE THAT EACH COURSE IS COMPLETELY UNIT FILLED, BACKFILLED AND COMPACTED PRIOR TO PROCEEDING TO NEXT COURSE.

3.05 DRAINAGE SYSTEM PLACEMENT

A. A DRAINAGE SYSTEM SHALL BE PROVIDED AT THE BASE OF THE WALL SYSTEM BEHIND THE RECON UNITS.

B. THE DRAINAGE SYSTEM SHALL CONSIST OF 4" PERFORATED POLYETHYLENE (PE) PIPE WRAPPED WITH GEOTEXTILE FABRIC.

C. THE PIPE SHALL BE INSTALLED WITH POSITIVE DRAINAGE, 1% MINIMUM.

3.06 FILL PLACEMENT

A. BACKFILL PLACEMENT SHALL CLOSELY FOLLOW ERECTION OF EACH ROW OF BLOCKS. BACKFILL SHALL BE PLACED IN A WAY THAT DOES NOT CAUSE DAMAGE OR DISTURBANCE TO THE WALL.

B. THE AREA IN FRONT AND AROUND THE LEVELING PAD SHALL BE BACKFILLED AS SOON AS PRACTICALLY POSSIBLE.

C. BACKFILL MATERIAL SHALL BE PLACED WITH A MAXIMUM OF 8" LIFTS AND COMPACTED TO 95% OF STANDARD PROCTOR DENSITY AS DETERMINED IN ACCORDANCE WITH ASTM D698. THE IN PLACE MOISTURE CONTENT SHALL NOT EXCEED THE OPTIMUM MOISTURE CONTENT AS DETERMINED IN ACCORDANCE WITH ASTM D698 AND BE NO LOWER THAN 2% BELOW OPTIMUM MOISTURE CONTENT.

D. CRUSHED STONE BACKFILL COMPACTION REQUIREMENTS:

1. CRUSHED STONE BACKFILL SHALL BE PLACED IN UNIFORM MAXIMUM LIFTS OF 9".
2. THE CRUSHED STONE BACKFILL SHALL BE COMPACTED BY A MINIMUM OF 3 PASSES OF A VIBRATORY COMPACTOR CAPABLE OF EXERTING 2,000 LBS OF CENTRIFUGAL FORCE AND TO THE SATISFACTION OF THE ONSITE GEOTECHNICAL ENGINEER OR THEIR DESIGNATED REPRESENTATIVE.

E. COMPACTION WITHIN 3 FEET OF BACK FACE OF WALL SHALL BE ACHIEVED BY MEANS OF A MINIMUM 3 PASSES WITH A LIGHTWEIGHT MECHANICAL TAMPER, ROLLER, OR VIBRATORY SYSTEM. MAXIMUM LIFT SIZE SHALL NOT EXCEED 8 INCHES LOOSE. SOIL DENSITY IN THIS AREA SHALL NOT BE LESS THAN 90% STANDARD PROCTOR DENSITY.

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No.	Date	Revision	By
1	2.02.2016	REVISE BLOCK AND QUANTITIES	TPH
2			
3			
4			
5			
6			

Designed By: TPH
Scale: N.T.S.
Date: JAN 28, 2016

Project: WAITSFIELD BRF 013-4(39)
WAITSFIELD, VERMONT

Title: SPECIFICATIONS

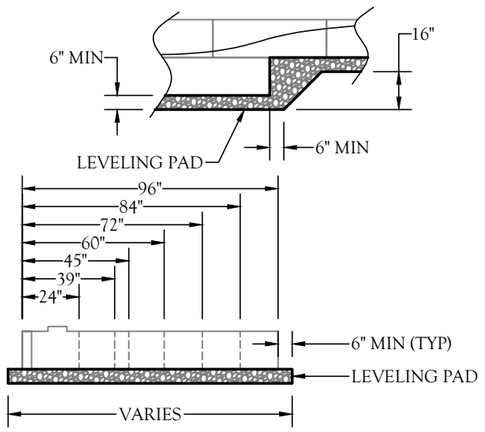
Registration No: 8619
Project No: 15-0789
Sheet No: 3.00

STATE OF VERMONT
MICHAEL ROBERT JOHNSON
LICENSED PROFESSIONAL ENGINEER

MICHAEL R. JOHNSON, P.E. Date: 2/2/16

NOTES:

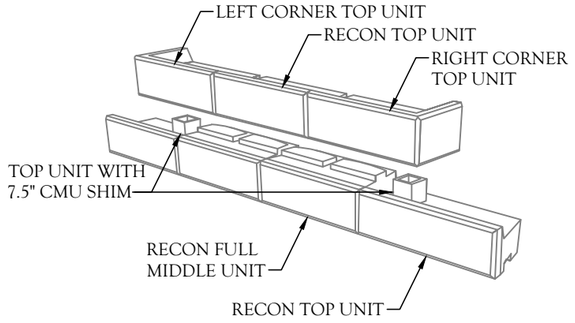
1. THE LEVELING PAD SHALL BE CONSTRUCTED OF CRUSHED STONE OR 2,000 PSI± UNREINFORCED CONCRETE.
2. THE CONTRACTOR SHALL HAVE A QUALIFIED GEOTECHNICAL ENGINEER VERIFY THE FOUNDATION SOILS TO ENSURE THAT IT MEETS OR EXCEEDS THE MINIMUM BEARING CAPACITY REQUIREMENTS.
3. THE BASE FOUNDATION SHALL BE APPROVED PRIOR TO PLACEMENT OF THE LEVELING PAD.



1 4.00 LEVELING PAD
SCALE: N.T.S.

NOTES:

1. IT WILL BE NECESSARY FOR BLOCK STABILITY TO ADD A CONCRETE SHIM BENEATH THE PORTION OF THE TOP CORNER UNIT THAT BEARS ON PART OF ANOTHER UNIT LOCATED BELOW.
2. THE SHIM IS TYPICALLY A STANDARD CONCRETE MASONRY UNIT (CMU). USING ADHESIVE ON THE SHIM WILL RESIST MOVEMENT DURING CONSTRUCTION.



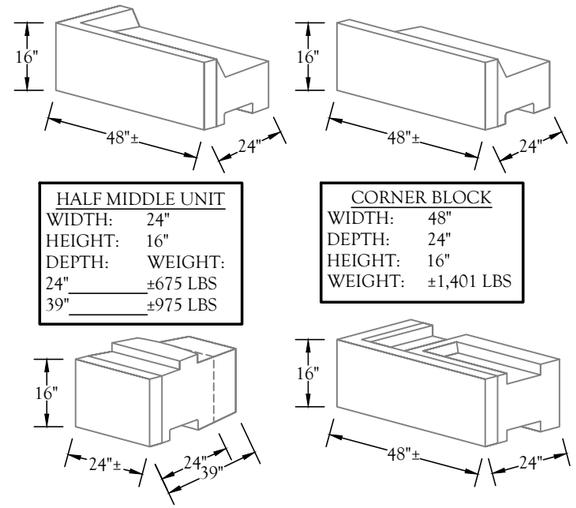
2 4.00 STANDARD TOP OF WALL STEP
SCALE: N.T.S.

CORNER TOP	
WIDTH:	48"
DEPTH:	24"
HEIGHT:	16"
WEIGHT:	±1,103 LBS

TOP UNIT	
WIDTH:	48"
DEPTH:	24"
HEIGHT:	16"
WEIGHT:	±971 LBS

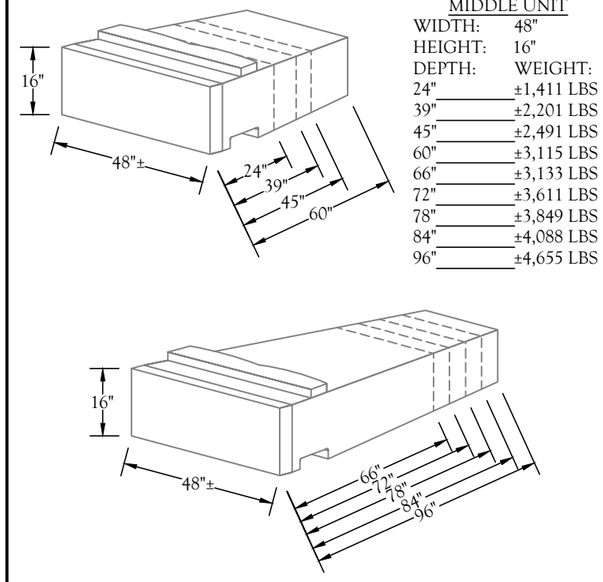
HALF MIDDLE UNIT	
WIDTH:	24"
HEIGHT:	16"
DEPTH:	WEIGHT:
24"	±675 LBS
39"	±975 LBS

CORNER BLOCK	
WIDTH:	48"
DEPTH:	24"
HEIGHT:	16"
WEIGHT:	±1,401 LBS



3 4.00 RECON UNITS
SCALE: N.T.S.

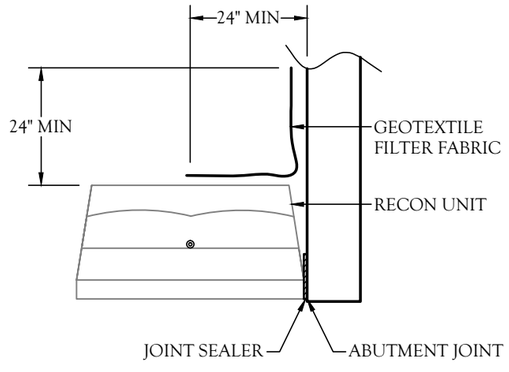
MIDDLE UNIT	
WIDTH:	48"
HEIGHT:	16"
DEPTH:	WEIGHT:
24"	±1,411 LBS
39"	±2,201 LBS
45"	±2,491 LBS
60"	±3,115 LBS
66"	±3,133 LBS
72"	±3,611 LBS
78"	±3,849 LBS
84"	±4,088 LBS
96"	±4,655 LBS



4 4.00 RECON MIDDLE UNITS
SCALE: N.T.S.

NOTES:

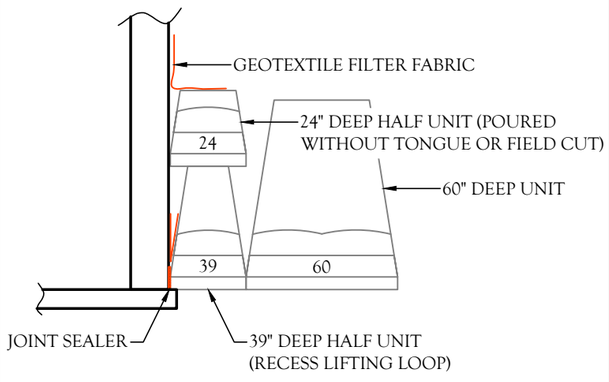
1. A GEOTEXTILE FABRIC SHALL BE PLACED WHERE THE RETAINING WALLS ABUT TO EXISTING FOUNDATIONS AS SHOWN ON THE RETAINING WALL SITE PLAN. OVERLAP ALL ABUTMENT JOINTS 24" WITH A MINIMUM 48" WIDE FABRIC.



5 4.00 ABUTMENT WRAP
SCALE: N.T.S.

NOTES:

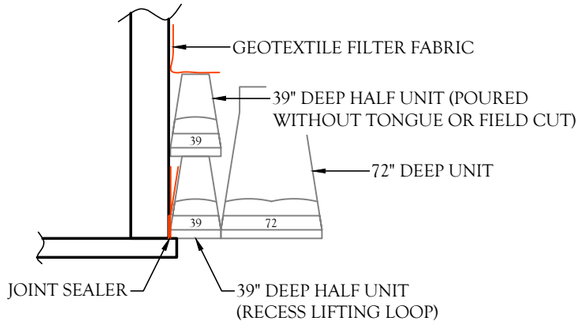
1. WHEN DOUBLE STACKING HALF UNITS, THE FRONT BLOCK SHALL BE CAST WITH THE REAR LIFTING LOOP RECESSED.
2. THE REAR BLOCK SHALL BE CAST WITHOUT A TONGUE IF THE TONGUE WILL PREVENT THE BLOCK PLACED ABOVE THE DOUBLE STACK FROM RESTING ON A LEVEL SURFACE.
3. PLACE A GEOTEXTILE FABRIC AT ABUTMENT.



6 4.00 DOUBLE STACKING ABUTMENT (60")
SCALE: N.T.S.

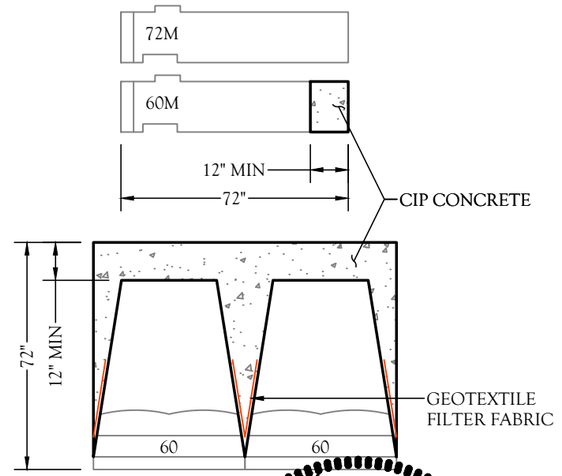
NOTES:

1. WHEN DOUBLE STACKING HALF UNITS, THE FRONT BLOCK SHALL BE CAST WITH THE REAR LIFTING LOOP RECESSED.
2. THE REAR BLOCK SHALL BE CAST WITHOUT A TONGUE IF THE TONGUE WILL PREVENT THE BLOCK PLACED ABOVE THE DOUBLE STACK FROM RESTING ON A LEVEL SURFACE.
3. PLACE A GEOTEXTILE FABRIC AT ABUTMENT.



7 4.00 DOUBLE STACKING ABUTMENT (72")
SCALE: N.T.S.

IF 72" DEEP UNITS CAN NOT BE PRECAST:



if needed

8 4.00 CIP 72" DEEP UNIT
SCALE: N.T.S.

STATE OF VERMONT
MICHAEL ROBERT JOHNSON
LICENSED PROFESSIONAL ENGINEER

MICHAEL R. JOHNSON, P.E. Date: 2/2/16

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Designed By: TPH	Project: WAITSFIELD BRF 013-4(39) WAITSFIELD, VERMONT	Registration No: 8619
Scale: AS NOTED		Project No: 15-0789
Date: JAN 28, 2016	Title: TYPICAL UNIT DETAIL	Sheet No: 4.00

NOTES:

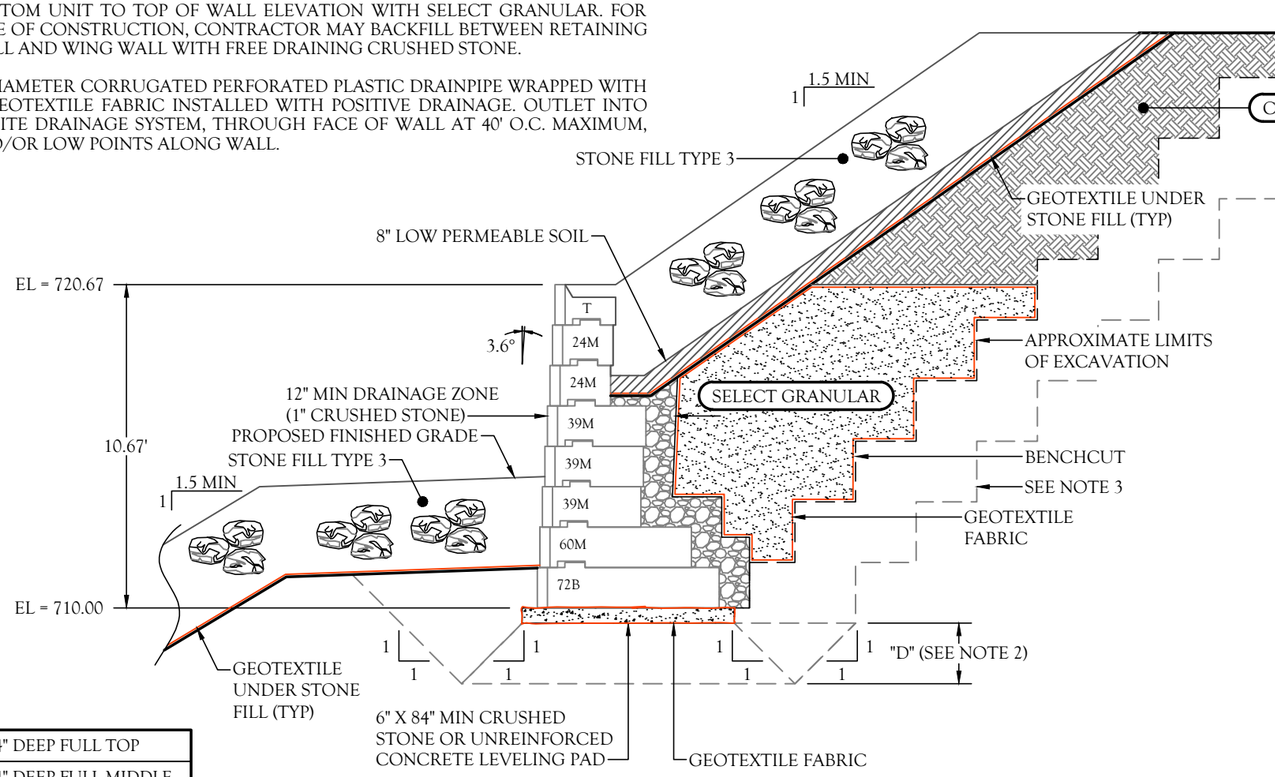
1. THE SECTION SHOWN IS A REPRESENTATIVE WALL SECTION. THE WALL HEIGHTS, ELEVATIONS, TOE SLOPES, AND BACK SLOPES VARY ACCORDING TO THE ELEVATION PLAN AND SITE PLAN RESPECTIVELY. SECTIONS AND DETAILS APPLY TO SAME AND SIMILAR CONDITIONS UNLESS SPECIFICALLY NOTED OTHERWISE.
2. UPON EXCAVATION, WHERE UNSUITABLE SOILS ARE FOUND, SUBCUT TO DEPTH "D" AS REQUIRED BY THE ONSITE GEOTECHNICAL ENGINEER AND REPLACE WITH SUITABLE COMPACTED STRUCTURAL FILL TO ACHIEVE THE REQUIRED BEARING CAPACITY. THE STRUCTURAL FILL SHALL BE COMPACTED TO A MINIMUM 95% STANDARD PROCTOR DENSITY.
3. APPROXIMATE LIMITS OF EXCAVATION VARIES WHERE SUBCUT IS REQUIRED. ACTUAL LIMITS AND SIDE SLOPES SHALL BE DETERMINED BY OSHA REGULATIONS AND MATCH FIELD CONDITIONS AS DETERMINED BY THE CONTRACTOR.
4. ALL WORK AND MATERIALS SHALL COMPLY WITH ALL STATE, COUNTY, AND CITY REGULATIONS AND CODES AS WELL AS OSHA STANDARDS.
5. THE WALLS SHALL BE CONSTRUCTED WITH RECON SERIES 50: 24", 39", 60", AND 72" DEEP UNITS USING 3.6° BATTER.
6. THE WALLS SHALL BE BACKFILLED UP AT A 1H:1V OFF THE BACK OF THE BOTTOM UNIT TO TOP OF WALL ELEVATION WITH SELECT GRANULAR. FOR EASE OF CONSTRUCTION, CONTRACTOR MAY BACKFILL BETWEEN RETAINING WALL AND WING WALL WITH FREE DRAINING CRUSHED STONE.
7. 4" DIAMETER CORRUGATED PERFORATED PLASTIC DRAINPIPE WRAPPED WITH A GEOTEXTILE FABRIC INSTALLED WITH POSITIVE DRAINAGE. OUTLET INTO ONSITE DRAINAGE SYSTEM, THROUGH FACE OF WALL AT 40' O.C. MAXIMUM, AND/OR LOW POINTS ALONG WALL.

NOTES:

8. TO PREVENT PONDING OF WATER, POSITIVE DRAINAGE SHALL BE PROVIDED AT THE TOP AND BOTTOM OF WALL. INSPECT EXCAVATION SLOPES FOR ACTIVE SEEPAGE AND PLACE ADDITIONAL DRAINS WHERE SEEPAGE OCCURS.
9. THE WORK SHALL BE PERFORMED IN A GENERAL SEQUENCE DEVELOPED BY THE CONTRACTOR IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONTRACT. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE MEANS AND METHODS OF CONSTRUCTION AND FOR THE SEQUENCES AND PROCEDURES TO BE USED.
10. ALL AVAILABLE MEANS AND METHODS SHALL BE USED TO KEEP EXCAVATION FOR THE RETAINING WALLS WITHIN THE CONSTRUCTION LIMITS SHOWN ON THE PLANS. EXCAVATION SLOPES SHALL BE DETERMINED BY OSHA REGULATIONS AND IN-SITU SOIL CONDITIONS.
11. DURING WALL EXCAVATION, BENCHCUT AS REQUIRED TO FACILITATE BACKFILL OPERATION AND BOND BETWEEN IN-SITU MATERIAL AND BACKFILL MATERIAL.
12. AT THE END OF EACH DAY'S OPERATION, SLOPE THE LAST LIFT OF BACKFILL TO DIRECT SURFACE RUNOFF AWAY FROM THE WALL. DO NOT ALLOW SURFACE RUNOFF FROM ADJACENT AREAS TO ENTER WALL CONSTRUCTION AREA.

NOTES:

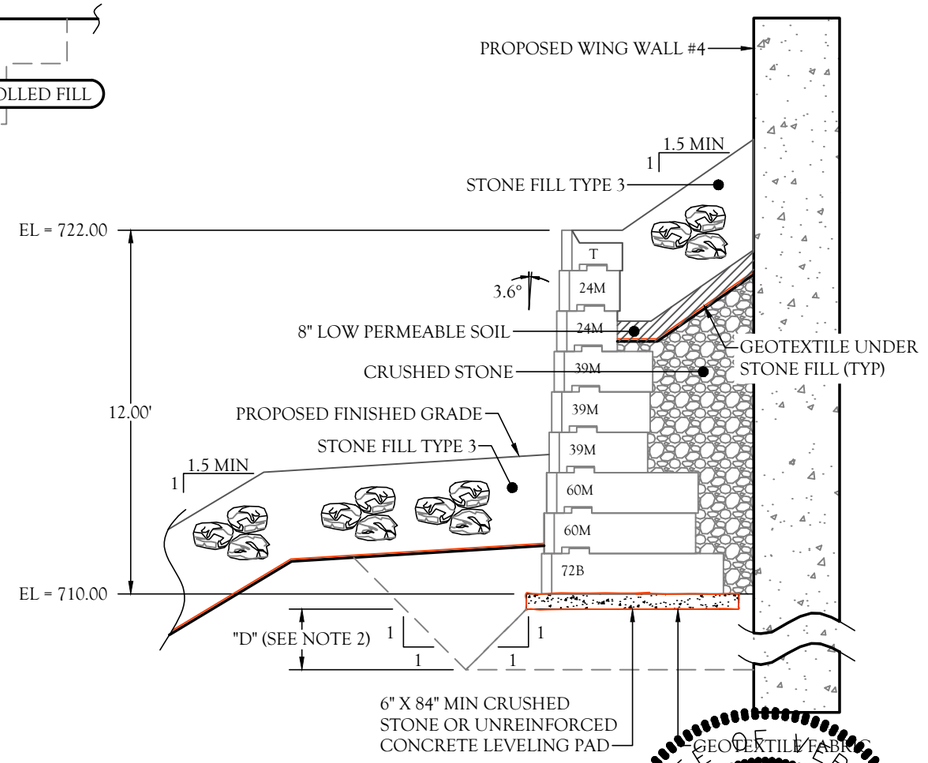
13. THE CONTRACTOR SHALL FIELD VERIFY ALL LOCATIONS AND DEPTHS OF EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. IF CONFLICTS EXIST THE ENGINEER SHALL BE CONTACTED IMMEDIATELY. THE CONTRACTOR SHALL COORDINATE RELOCATION OF ALL EXISTING CONDUITS AND SERVICES WITH THE UTILITY PROVIDER.
14. DO NOT BRING HEAVY COMPACTION OR PAVING EQUIPMENT WITHIN 3 FEET OF THE BACK OF THE RETAINING WALL. ONLY HAND-OPERATED COMPACTION EQUIPMENT (E.G. TAMPER, PLATE COMPACTOR, SHEEP'S FOOT ROLLER) SHALL BE USED WITHIN 3 FEET OF THE BACK OF THE RETAINING WALL UNITS.
15. IF, DURING THE PERFORMANCE OF THE WORK, THE CONTRACTOR FINDS A CONFLICT, ERROR, OR DISCREPANCY IN THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL SO REPORT TO THE ENGINEER IN WRITING AT ONCE. BEFORE PROCEEDING WITH THE AFFECTED THEREBY, THE CONTRACTOR SHALL OBTAIN A WRITTEN INTERPRETATION OR CLARIFICATION FROM THE ENGINEER. WORK DONE BEFORE THE ENGINEER RENDERS HIS DECISION IS AT THE CONTRACTOR'S SOLE RISK.
16. SEE MANUFACTURERS INFORMATION FOR ADDITIONAL DETAILS ON THE RECON RETAINING WALL SYSTEM. THE MANUFACTURER INFORMATION SHALL ACCOMPANY THE CONSTRUCTION PLANS.



T	24" DEEP FULL TOP
24M	24" DEEP FULL MIDDLE
39M	39" DEEP FULL MIDDLE
60M	60" DEEP FULL MIDDLE
72B	72" DEEP FULL BOTTOM

TYPICAL GRAVITY WALL SECTION A - A

(WALL 1 SECTION SHOWN AT 16.00')



GRAVITY WALL 2 SECTION B - B

(WALL 2 SECTION SHOWN AT 4.00')

CIVIL DESIGN PROFESSIONALS
8609 LYNDALE AVENUE SOUTH, SUITE 200 BLOOMINGTON, MN 55420
PHONE: (952) 303-5312 | FAX: (763) 392-1989 | WEBSITE: WWW.CDP-US.COM
SITE SOLUTION PROFESSIONALS, INC. D.B.A. CIVIL DESIGN PROFESSIONALS

No.	Date	Revision	By
1	2.02.2016	REVISE BLOCK AND QUANTITIES	TPH
2			
3			
4			
5			
6			

Designed By:	TPH
Scale:	1"=5'
Date:	JAN 28, 2016
Project:	WAITSFIELD BRF 013-4(39) WAITSFIELD, VERMONT
Title:	WALL SECTIONS
Registration No:	8619
Project No:	15-0789
Sheet No:	5.00

STATE OF VERMONT
MICHAEL ROBERT JOHNSON
LICENSED
PROFESSIONAL ENGINEER

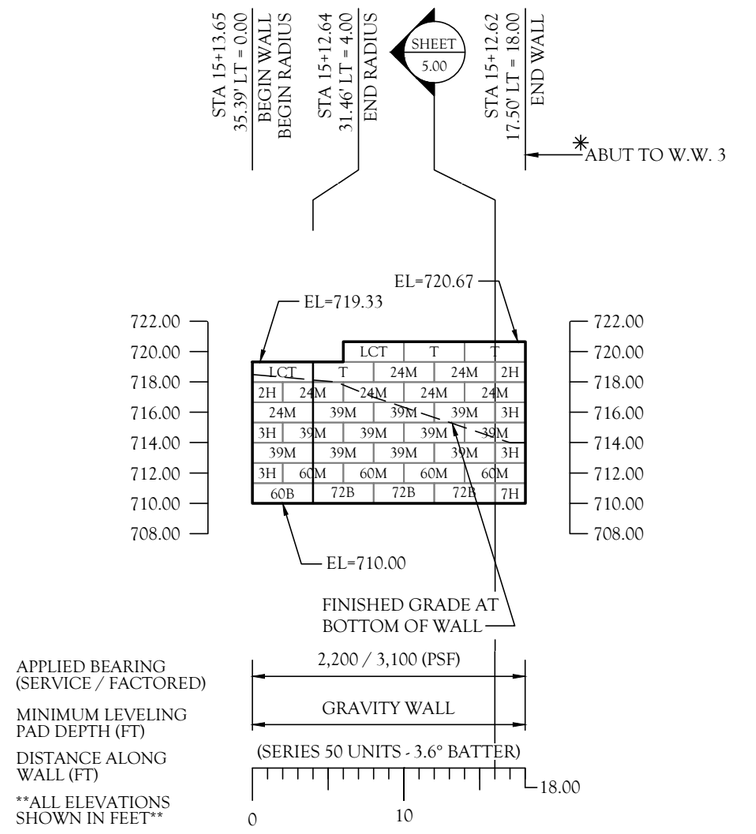
MICHAEL R. JOHNSON, P.E. Date: 2/2/16

NOTES:

1. THE WALLS SHALL BE CONSTRUCTED WITH RECON SERIES 50: 24", 39", 60", AND 72" DEEP UNITS USING 3.6° BATTER.
2. THE WALLS SHALL BE BACKFILLED UP AT A 1H:1V OFF THE BACK OF THE BOTTOM UNIT TO TOP OF WALL ELEVATION WITH SELECT GRANULAR.
3. ✳ A GEOTEXTILE FABRIC SHALL BE PLACED WHERE RETAINING WALLS ABUT TO EXISTING FOUNDATIONS AS SHOWN ON THE PLAN SHEETS. OVERLAP ALL ABUTMENT JOINTS 24" WITH A MINIMUM 48" WIDE FABRIC (SEE DETAIL 5, SHEET 4.00).
4. ALL STATIONS AND OFFSETS ARE TO THE FRONT FACE OF WALL AT THE PROPOSED GROUND LINE (UNLESS OTHERWISE NOTED).
5. CONSTRUCTION FOR WALLS WITH AN ABUTMENT SHALL BEGIN FROM EXISTING STRUCTURES TOWARDS THE OPEN END OF THE WALL (SEE DETAILS 5 AND 7, SHEET NO. 4.00).
6. WALL 1 IS NOT DESIGNED TO SUPPORT PROPOSED WING WALL #3. THE DESIGN OF WING WALL #3 SHALL APPLY NO LOAD UPON RETAINING WALL 1.
7. SEE MANUFACTURER INFORMATION FOR ADDITIONAL CONSTRUCTION DETAILS FOR THE RECON RETAINING WALL SYSTEM. THE MANUFACTURER INFORMATION SHALL ACCOMPANY THE CONSTRUCTION PLANS.

RECON WALL 1		
LCT	LEFT CORNER TOP	2
T	TOP BLOCK	3
24M	24" DEEP MIDDLE BLOCK	7
2H	24" DEEP HALF MIDDLE	2
39M	39" DEEP MIDDLE BLOCK	11
3H	39" DEEP HALF MIDDLE	4
60M	60" DEEP MIDDLE BLOCK	4
60B	60" DEEP BOTTOM BLOCK	1
7H	(2) - 39" DEEP HALF MIDDLES	1
72B	72" DEEP BOTTOM BLOCK	3
WWW.RECONWALLS.COM		

CONTRACTOR SHALL CONFIRM ALL QUANTITIES



RECON WALL 1 - FRONT FACE ELEVATION

CIVIL DESIGN PROFESSIONALS
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PHONE: (952) 303-5312 | FAX: (763) 392-1989 | WEBSITE: WWW.CDP-US.COM
SITE SOLUTION PROFESSIONALS, INC. D.B.A. CIVIL DESIGN PROFESSIONALS

No.	Date	Revision	By
1	2.02.2016	REVISE BLOCK AND QUANTITIES	TPH
2			
3			
4			
5			
6			

Designed By: TPH	Project: WAITSFIELD BRF 013-4(39) WAITSFIELD, VERMONT	Registration No: 8619
Scale: 1" = 10'		Project No: 15-0789
Date: JAN 28, 2016	Title: WALL 1 ELEVATION	Sheet No: 6.00

STATE OF VERMONT
MICHAEL ROBERT JOHNSON
LICENSED PROFESSIONAL ENGINEER

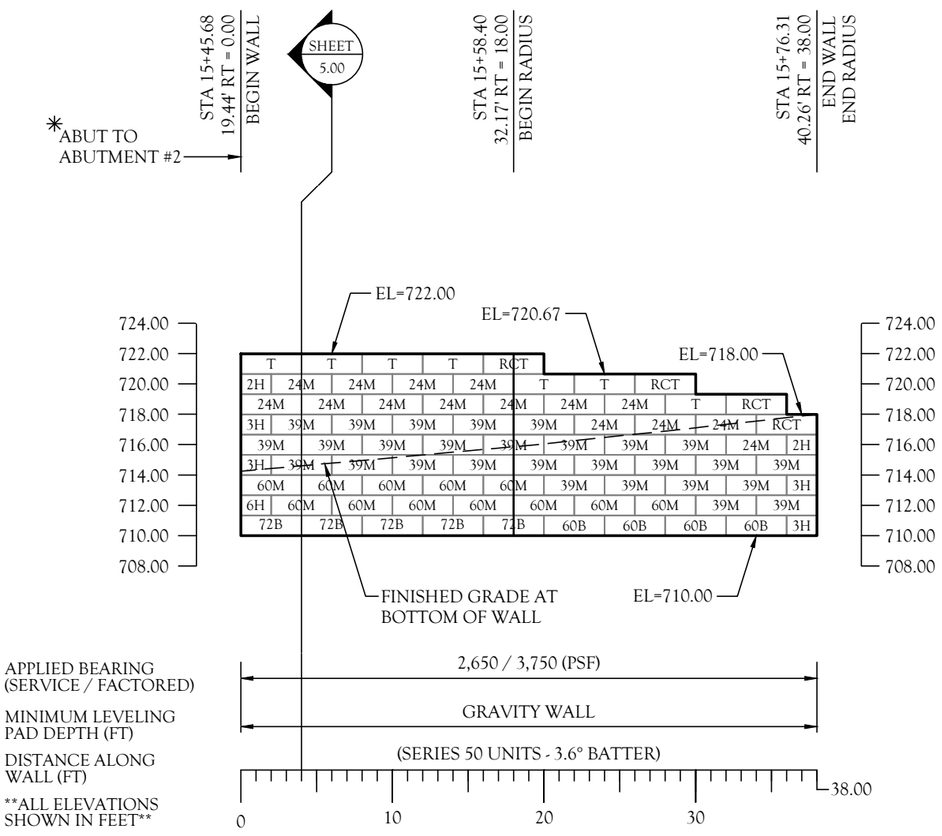
MICHAEL R. JOHNSON, P.E. Date: 2/2/16

NOTES:

1. THE WALLS SHALL BE CONSTRUCTED WITH RECON SERIES 50: 24", 39", 60", AND 72" DEEP UNITS USING 3.6° BATTER.
2. THE WALLS SHALL BE BACKFILLED UP AT A 1H:1V OFF THE BACK OF THE BOTTOM UNIT TO TOP OF WALL ELEVATION WITH SELECT GRANULAR.
3. ✳ A GEOTEXTILE FABRIC SHALL BE PLACED WHERE RETAINING WALLS ABUT TO EXISTING FOUNDATIONS AS SHOWN ON THE PLAN SHEETS. OVERLAP ALL ABUTMENT JOINTS 24" WITH A MINIMUM 48" WIDE FABRIC (SEE DETAIL 5, SHEET 4.00).
4. ALL STATIONS AND OFFSETS ARE TO THE FRONT FACE OF WALL AT THE PROPOSED GROUND LINE (UNLESS OTHERWISE NOTED).
5. CONSTRUCTION FOR WALLS WITH AN ABUTMENT SHALL BEGIN FROM EXISTING STRUCTURES TOWARDS THE OPEN END OF THE WALL (SEE DETAILS 5 AND 6, SHEET NO. 4.00).
6. WALL 2 IS NOT DESIGNED TO SUPPORT PROPOSED WING WALL #4. THE DESIGN OF WING WALL #4 SHALL APPLY NO LOAD UPON RETAINING WALL 2.
7. SEE MANUFACTURER INFORMATION FOR ADDITIONAL CONSTRUCTION DETAILS FOR THE RECON RETAINING WALL SYSTEM. THE MANUFACTURER INFORMATION SHALL ACCOMPANY THE CONSTRUCTION PLANS.

RECON WALL 2		
RCT	RIGHT CORNER TOP	4
T	TOP BLOCK	7
24M	24" DEEP MIDDLE BLOCK	15
2H	24" DEEP HALF MIDDLE	2
3H	39" DEEP HALF MIDDLE	4
39B	39" DEEP BOTTOM BLOCK	28
60M	60" DEEP MIDDLE BLOCK	12
6H	24" AND 39" DEEP HALF MIDDLES	1
60B	60" DEEP BOTTOM BLOCK	4
72B	72" DEEP BOTTOM BLOCK	5
WWW.RECONWALLS.COM		

CONTRACTOR SHALL CONFIRM ALL QUANTITIES



RECON WALL 2 - FRONT FACE ELEVATION

ABUTMENT NOTE:
AT ABUTMENT LOCATION, PROPOSED WING WALL 4 MAY OBSTRUCT THE PLACEMENT OF DEEPER RECON UNITS. CONTRACTOR MAY FIELD CUT BLOCK ONSITE OR USE RECON FITTING BLOCKS WITH CAST IN PLACE CONCRETE TO CREATE THE REQUIRED DEPTH.

CIVIL DESIGN PROFESSIONALS
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SITE SOLUTION PROFESSIONALS, INC. D.B.A. CIVIL DESIGN PROFESSIONALS

No.	Date	Revision	By
1	2.02.2016	REVISE BLOCK AND QUANTITIES	TPH
2			
3			
4			
5			
6			

Designed By: TPH	Project: WAITSFIELD BRF 013-4(39) WAITSFIELD, VERMONT	Registration No: 8619
Scale: 1" = 10'		Project No: 15-0789
Date: JAN 28, 2016	Title: WALL 2 ELEVATION	Sheet No: 6.01

STATE OF VERMONT
MICHAEL ROBERT JOHNSON
LICENSED PROFESSIONAL ENGINEER

MICHAEL R. JOHNSON, P.E. Date: 2/2/16

CIVIL DESIGN PROFESSIONALS

INNOVATIVE ENGINEERING SOLUTIONS

DESIGN CALCULATIONS

FOR

Waitsfield BRF 013-4(39)

Waitsfield, Vermont

(PROJECT # 15-0789)

Vermont Agency of Transportation
RECEIVED
ON: February 24, 2016
and Checked for
CONFORMANCE
BY: Rob Young DATE: 03/22/2016

STATE OF VERMONT
MICHAEL ROBERT JOHNSON
LICENSED
PROFESSIONAL ENGINEER

SUBMITTED BY:

Tim Hatten

January 28, 2016

_____ Approved _____X_____ Approved As Noted
_____ Rejected

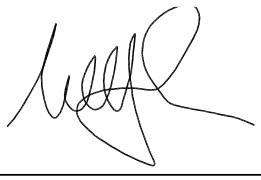
This review is only for general conformance with the design concept and the information given in the Construction Documents. Corrections or comments made on the shop drawings during the review do not relieve the Contractor from compliance with the requirements of the Plans and Specifications. Review of a specific item shall not include review of an assembly of which an item is a component. The Contractor is responsible for dimensions to be confirmed and corrected at the job site; information that pertains solely to the fabrication process or to the means, methods, techniques, sequences and procedures of construction; coordination of the Work with that of other trades and performing all Work in a safe and satisfactory manner.

McFarland Johnson

Date 3/22/2016

By D. Kull

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF VERMONT. THE CALCULATIONS MODEL WORST CASE CONDITIONS AND COVER ALL OF THE PROPOSED MODULAR BLOCK WALLS FOR THIS SPECIFIC PROJECT.



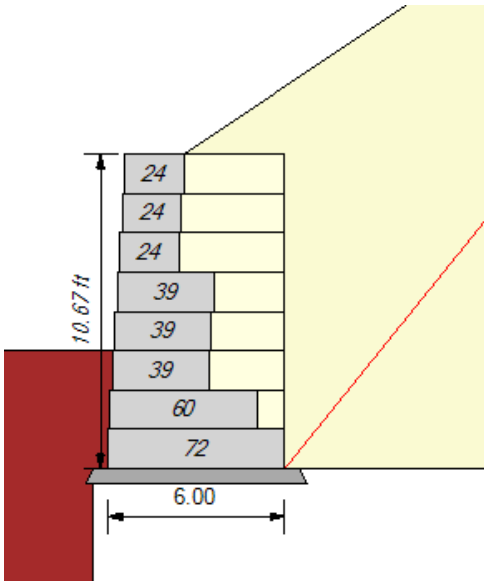
DATE: 1/28/16

MICHAEL R. JOHNSON, P.E. LICENSE NO. 8619

CIVIL DESIGN PROFESSIONALS
INNOVATIVE ENGINEERING SOLUTIONS

REAWall

Version: 4.0 Build 15355



Project:	Waitsfield brf 013-4(39)
Location:	Vermont
Designer:	TPH
Date:	1/12/2016
Section:	Wall 1
Design Method:	AASHTO_LRFD_2012
Design Unit:	ReCon Series 50 - CIP

SOIL PARAMETERS	φ	coh	γ
Retained Soil:	34 deg	0 psf	140 pcf
Foundation Soil:	38 deg	0 psf	130 pcf
Leveling Pad:	40 deg	0 psf	140 pcf
	Crushed Stone		

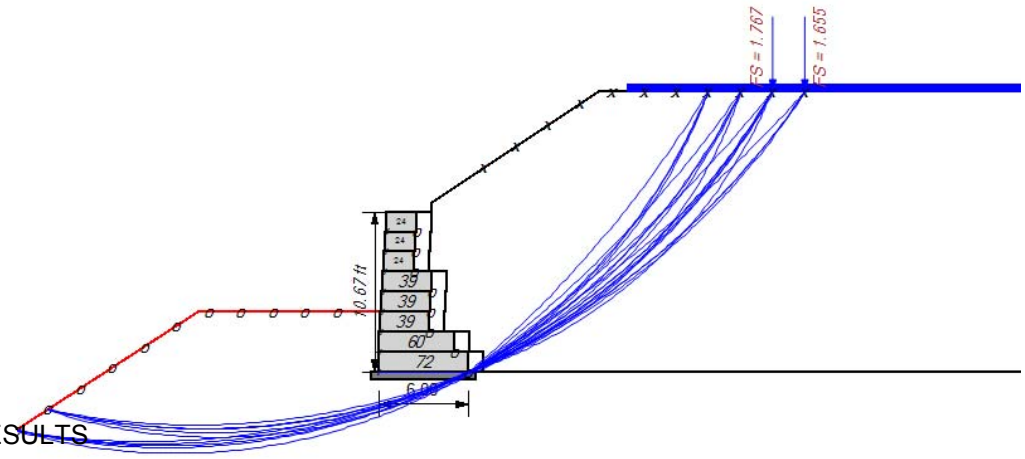
GEOMETRY

Design Height:	10.67 ft	Live Load:	150 psf
Wall Batter/Tilt:	3.58/ 0.00 deg	Live Load Offset:	14.00 ft
Embedment:	4.00 ft	Live Load Width:	50 ft
Leveling Pad Depth:	0.50 ft	Dead Load:	0 psf
Slope Angle:	33.7 deg	Dead Load Offset:	0.0 ft
Slope Length:	12.0 ft	Dead Load Width:	0 ft
Slope Toe Offset:	0.0 ft	Leveling Pad Width:	7.00 ft
		Toe Slope Angle:	33.00
		Toe Slope Length:	13.00
		Toe Slope Bench:	12.00

RESULTS

CDR Sliding:	1.03 (lvlpd)	CDR Bearing:	7.51
Eccentricity (e/L):	0.22 (e/L <= 0.33)	Bearing:	3004 / 2178 (Service)
Ecc Internal(e/L):	0.41 (e/L <= 0.45)		

Name	Elev.[dpth]	ka	Pa	Paq	Paqd	(PaC)	PaT	CDRsl(Lvl Pad)	e/L	e/L (Srvs)	%D/H
24	9.33[1.34]	0.564	70	0	0	0	70	60.61	0.03	150%	
24	8.00[2.67]	0.549	274	0	0	0	274	15.98	0.14	75%	
24	6.67[4.00]	0.524	588	0	0	0	588	7.63	0.34	50%	
39	5.33[5.34]	0.570	1137	11	0	0	1148	4.47	0.19	61%	
39	4.00[6.67]	0.543	1691	22	0	0	1713	3.13	0.29	49%	
39	2.67[8.00]	0.518	2321	51	0	0	2372	2.36	0.41	41%	
60	1.33[9.34]	0.518	3163	130	0	0	3293	1.92	0.25	54%	
72	0.00[10.67]	0.510	4063	200	0	0	4262	1.03 (1.29)	0.22	56%	



COMPOUND RESULTS

Compound stability is a global analysis (Bishop) with the failure planes originating at the top of the slope / wall and exiting out through the face of the wall. For MSE walls, the resistance of the geogrid reinforcement is included in the analysis and the shear resistance of the face units is included.

ID	Enter Point X	Enter Point Y	Exit Point X	Exit Point Y	Center X	Center Y	Radius	FoS
2	28.34	18.67	6.00	0.00	-50.47	90.26	106.47	1.655
2	26.21	18.67	6.00	0.00	-47.78	78.46	95.12	1.668
2	24.07	18.67	6.00	0.00	-45.26	67.69	84.91	1.685
3	28.34	18.67	6.00	0.00	-16.17	49.22	53.98	1.695
3	26.21	18.67	6.00	0.00	-15.33	43.35	48.31	1.698
3	24.07	18.67	6.00	0.00	-14.57	37.99	43.20	1.704
2	21.94	18.67	6.00	0.00	-42.95	57.92	75.84	1.722
3	21.94	18.67	6.00	0.00	-13.92	33.14	38.67	1.727
4	24.07	18.67	6.00	0.00	-4.10	27.86	29.64	1.769
4	26.21	18.67	6.00	0.00	-4.29	31.40	33.04	1.773

GLOBAL RESULTS

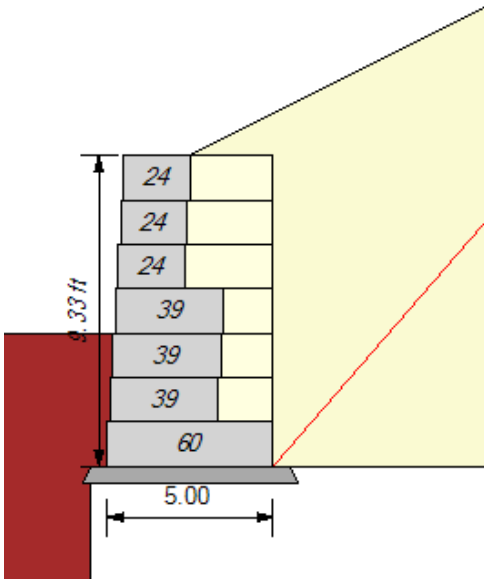
Global stability is a global analysis (Bishop) with the failure planes originating at the top of the slope / wall and exiting out below the wall in the area infront of the structure. For MSE walls, the resistance of the geogrid reinforcement is included in the analysis. The curve may go through the base of the wall and the wall shear would be included. In most cases the failure plane will pass below the structure.

ID	Enter Point X	Enter Point Y	Exit Point X	Exit Point Y	Center X	Center Y	Radius	FoS
1	26.21	18.67	-24.09	-3.85	-14.76	42.73	47.51	1.767
1	26.21	18.67	-21.96	-2.47	-11.55	39.26	43.00	1.777
2	26.21	18.67	-21.96	-2.47	-11.51	39.17	42.92	1.778
1	28.34	18.67	-24.09	-3.85	-15.49	48.41	52.96	1.779
1	24.07	18.67	-24.09	-3.85	-14.09	37.53	42.57	1.782
2	26.21	18.67	-24.09	-3.85	-14.34	41.80	46.68	1.789
1	24.07	18.67	-21.96	-2.47	-11.14	34.67	38.68	1.798
1	28.34	18.67	-21.96	-2.47	-11.99	44.22	47.74	1.817
1	21.94	18.67	-24.09	-3.85	-13.49	32.77	38.13	1.830
1	21.94	18.67	-21.96	-2.47	-10.77	30.45	34.77	1.831

CIVIL DESIGN PROFESSIONALS
INNOVATIVE ENGINEERING SOLUTIONS

REAWall

Version: 4.0 Build 15355



Project:	Waitsfield brf 013-4(39)
Location:	Vermont
Designer:	TPH
Date:	1/12/2016
Section:	Wall 2
Design Method:	AASHTO_LRFD_2012
Design Unit:	ReCon Series 50 - CIP

SOIL PARAMETERS	φ	coh	γ
Retained Soil:	34 deg	0 psf	140 pcf
Foundation Soil:	38 deg	0 psf	130 pcf
Leveling Pad:	40 deg	0 psf	140 pcf
	Crushed Stone		

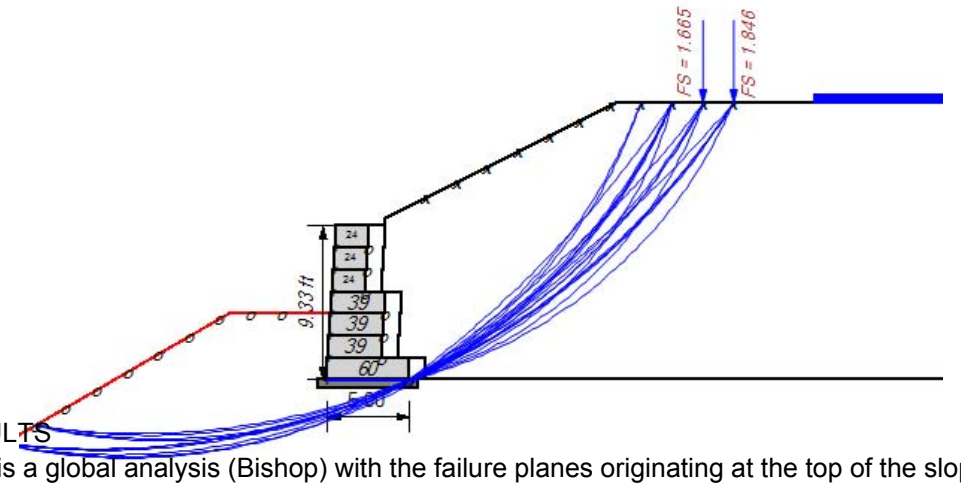
GEOMETRY

Design Height:	9.33 ft	Live Load:	250 psf
Wall Batter/Tilt:	3.58/ 0.00 deg	Live Load Offset:	27.00 ft
Embedment:	4.00 ft	Live Load Width:	50 ft
Leveling Pad Depth:	0.50 ft	Dead Load:	0 psf
Slope Angle:	26.6 deg	Dead Load Offset:	0.0 ft
Slope Length:	15.0 ft	Dead Load Width:	0 ft
Slope Toe Offset:	0.0 ft	Leveling Pad Width:	6.00 ft
		Toe Slope Angle:	30.00
		Toe Slope Length:	15.00
		Toe Slope Bench:	6.00

RESULTS

CDR Sliding:	1.21 (lvlpd)	CDR Bearing:	9.73
Eccentricity (e/L):	0.19 (e/L <= 0.33)	Bearing:	2339 / 1737 (Service)
Ecc Internal(e/L):	0.32 (e/L <= 0.45)		

Name	Elev.[dpth]	ka	Pa	Paq	Paqd	(PaC)	PaT	CDRsl(Lvl Pad)	e/L	e/L (Srvs)	%D/H
24	8.00[1.33]	0.358	44	0	0	0	44	96.24	0.02	150%	
24	6.67[2.66]	0.358	178	0	0	0	178	24.55	0.09	75%	
24	5.33[4.00]	0.358	401	0	0	0	401	11.17	0.23	50%	
39	4.00[5.33]	0.402	799	0	0	0	799	6.36	0.14	61%	
39	2.67[6.66]	0.402	1249	0	0	0	1249	4.24	0.22	49%	
39	1.33[8.00]	0.402	1800	0	0	0	1800	3.07	0.32	41%	
60	0.00[9.33]	0.417	2539	0	0	0	2539	1.21 (1.58)	0.19	54%	



COMPOUND RESULTS

Compound stability is a global analysis (Bishop) with the failure planes originating at the top of the slope / wall and exiting out through the face of the wall. For MSE walls, the resistance of the geogrid reinforcement is included in the analysis and the shear resistance of the face units is included.

ID	Enter Point X	Enter Point Y	Exit Point X	Exit Point Y	Center X	Center Y	Radius	FoS
2	24.66	16.84	5.00	0.00	-39.34	71.66	84.27	1.846
2	22.79	16.84	5.00	0.00	-37.34	62.55	75.53	1.863
3	22.79	16.84	5.00	0.00	-11.20	34.94	38.52	1.873
3	24.66	16.84	5.00	0.00	-11.77	39.47	42.88	1.874
3	20.93	16.84	5.00	0.00	-10.71	30.81	34.58	1.904
2	20.93	16.84	5.00	0.00	-35.47	54.23	67.67	1.906
4	22.79	16.84	5.00	0.00	-2.26	25.50	26.51	1.950
4	24.66	16.84	5.00	0.00	-2.36	28.49	29.42	1.956
3	19.06	16.84	5.00	0.00	-10.30	27.06	31.09	1.968
4	20.93	16.84	5.00	0.00	-2.21	22.77	23.89	1.973

GLOBAL RESULTS

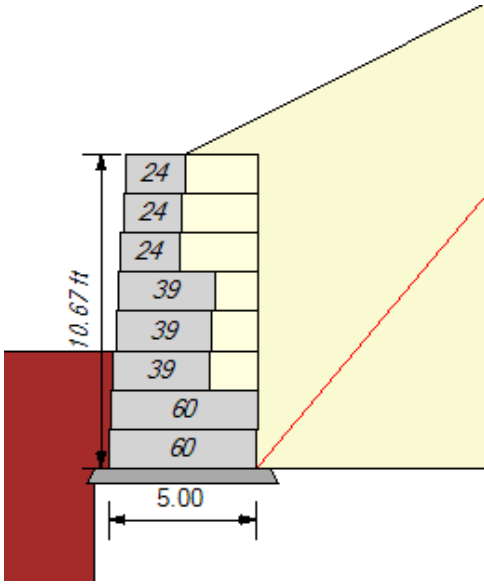
Global stability is a global analysis (Bishop) with the failure planes originating at the top of the slope / wall and exiting out below the wall in the area infront of the structure. For MSE walls, the resistance of the geogrid reinforcement is included in the analysis. The curve may go through the base of the wall and the wall shear would be included. In most cases the failure plane will pass below the structure.

ID	Enter Point X	Enter Point Y	Exit Point X	Exit Point Y	Center X	Center Y	Radius	FoS
1	22.79	16.84	-19.54	-3.82	-13.36	37.22	41.50	1.665
1	24.66	16.84	-19.54	-3.82	-14.14	42.24	46.38	1.673
2	24.66	16.84	-19.54	-3.82	-13.96	41.86	46.02	1.673
1	20.93	16.84	-19.54	-3.82	-12.65	32.64	37.11	1.674
1	20.93	16.84	-17.68	-2.74	-10.17	30.30	33.88	1.690
2	20.93	16.84	-19.54	-3.82	-12.16	31.68	36.26	1.704
1	19.06	16.84	-19.54	-3.82	-12.00	28.49	33.18	1.705
1	22.79	16.84	-17.68	-2.74	-10.66	34.37	37.77	1.709
2	20.93	16.84	-17.68	-2.74	-9.81	29.59	33.28	1.718
1	24.66	16.84	-17.68	-2.74	-11.20	38.80	42.05	1.719

CIVIL DESIGN PROFESSIONALS
INNOVATIVE ENGINEERING SOLUTIONS

REAWall

Version: 4.0 Build 15355



Project:	Waitsfield brf 013-4(39)
Location:	Vermont
Designer:	TPH
Date:	1/12/2016
Section:	Wall 2
Design Method:	AASHTO_LRFD_2012
Design Unit:	ReCon Series 50 - CIP

SOIL PARAMETERS	φ	coh	γ
Retained Soil:	34 deg	0 psf	140 pcf
Foundation Soil:	38 deg	0 psf	130 pcf
Leveling Pad:	40 deg	0 psf	140 pcf
	Crushed Stone		

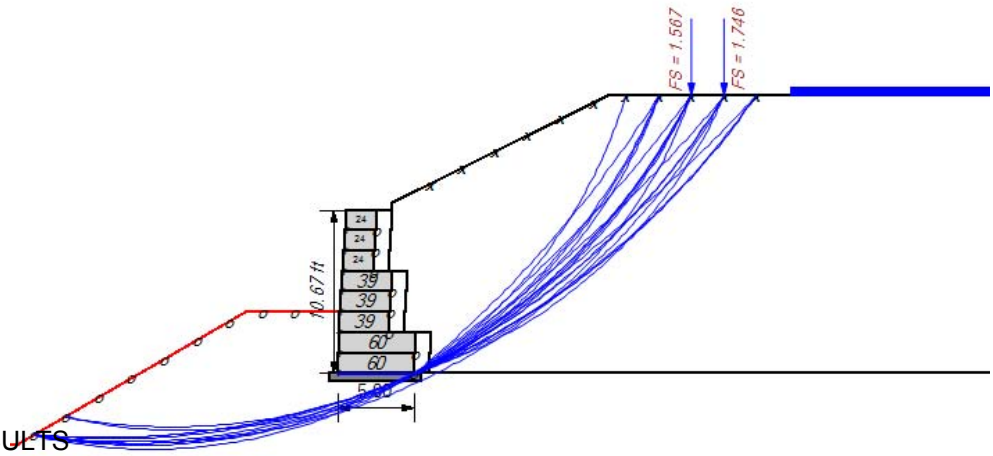
GEOMETRY

Design Height:	10.67 ft	Live Load:	250 psf
Wall Batter/Tilt:	3.58/ 0.00 deg	Live Load Offset:	27.00 ft
Embedment:	4.00 ft	Live Load Width:	50 ft
Leveling Pad Depth:	0.50 ft	Dead Load:	0 psf
Slope Angle:	26.6 deg	Dead Load Offset:	0.0 ft
Slope Length:	15.0 ft	Dead Load Width:	0 ft
Slope Toe Offset:	0.0 ft	Leveling Pad Width:	6.00 ft
		Toe Slope Angle:	30.00
		Toe Slope Length:	15.00
		Toe Slope Bench:	6.00

RESULTS

CDR Sliding:	1.10 (lvlpd)	CDR Bearing:	6.50
Eccentricity (e/L):	0.25 (e/L <= 0.33)	Bearing:	3067 / 2221 (Service)
Ecc Internal(e/L):	0.32 (e/L <= 0.45)		

Name	Elev.[dpth]	ka	Pa	Paq	Paqd	(PaC)	PaT	CDRsl(Lvl Pad)	e/L	e/L (Srvs)	%D/H
24	9.33[1.34]	0.358	45	0	0	0	45	95.28	0.02	150%	
24	8.00[2.67]	0.358	179	0	0	0	179	24.43	0.09	75%	
24	6.67[4.00]	0.358	402	0	0	0	402	11.13	0.23	50%	
39	5.33[5.34]	0.402	801	0	0	0	801	6.34	0.14	61%	
39	4.00[6.67]	0.402	1252	0	0	0	1252	4.23	0.22	49%	
39	2.67[8.00]	0.402	1803	0	0	0	1803	3.07	0.32	41%	
60	1.33[9.34]	0.417	2542	0	0	0	2542	2.46	0.19	54%	
60	0.00[10.67]	0.412	3286	0	0	0	3286	1.10 (1.42)	0.25	47%	



COMPOUND RESULTS

Compound stability is a global analysis (Bishop) with the failure planes originating at the top of the slope / wall and exiting out through the face of the wall. For MSE walls, the resistance of the geogrid reinforcement is included in the analysis and the shear resistance of the face units is included.

ID	Enter Point X	Enter Point Y	Exit Point X	Exit Point Y	Center X	Center Y	Radius	FoS
2	25.21	18.18	5.00	0.00	-46.34	77.37	92.86	1.746
2	27.34	18.18	5.00	0.00	-48.98	89.14	104.20	1.754
2	23.07	18.18	5.00	0.00	-43.87	66.65	82.65	1.765
3	25.21	18.18	5.00	0.00	-15.12	42.67	47.18	1.771
3	23.07	18.18	5.00	0.00	-14.39	37.34	42.07	1.776
3	27.34	18.18	5.00	0.00	-15.93	48.53	52.85	1.789
3	20.94	18.18	5.00	0.00	-13.75	32.52	37.54	1.811
2	20.94	18.18	5.00	0.00	-41.60	56.93	73.57	1.820
4	23.07	18.18	5.00	0.00	-4.32	27.34	28.88	1.836
4	25.21	18.18	5.00	0.00	-4.49	30.86	32.29	1.844

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ID	Enter Point X	Enter Point Y	Exit Point X	Exit Point Y	Center X	Center Y	Radius	FoS
1	23.07	18.18	-19.82	-3.98	-13.59	36.55	41.01	1.567
1	20.94	18.18	-19.82	-3.98	-12.81	31.69	36.35	1.575
1	25.21	18.18	-19.82	-3.98	-14.45	41.94	46.23	1.576
2	23.07	18.18	-19.82	-3.98	-13.26	35.91	40.42	1.577
1	27.34	18.18	-19.82	-3.98	-15.41	47.89	52.06	1.592
2	27.34	18.18	-19.82	-3.98	-15.37	47.82	51.99	1.592
1	20.94	18.18	-17.69	-2.75	-10.06	29.27	32.92	1.601
1	18.80	18.18	-19.82	-3.98	-12.11	27.32	32.24	1.614
1	23.07	18.18	-17.69	-2.75	-10.57	33.55	36.99	1.619
2	25.21	18.18	-19.82	-3.98	-12.92	38.82	43.35	1.620

CIVIL DESIGN PROFESSIONALS
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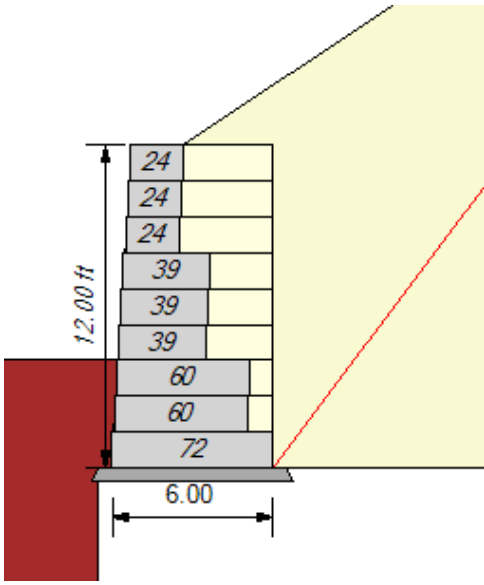
REAWall

Version: 4.0 Build 15355



Project:	Waitsfield brf 013-4(39)
Location:	Vermont
Designer:	TPH
Date:	1/12/2016
Section:	Wall 2
Design Method:	AASHTO_LRFD_2012
Design Unit:	ReCon Series 50 - CIP

SOIL PARAMETERS	φ	coh	γ
Retained Soil:	34 deg	0 psf	140 pcf
Foundation Soil:	38 deg	0 psf	130 pcf
Leveling Pad:	40 deg	0 psf	140 pcf
	Crushed Stone		

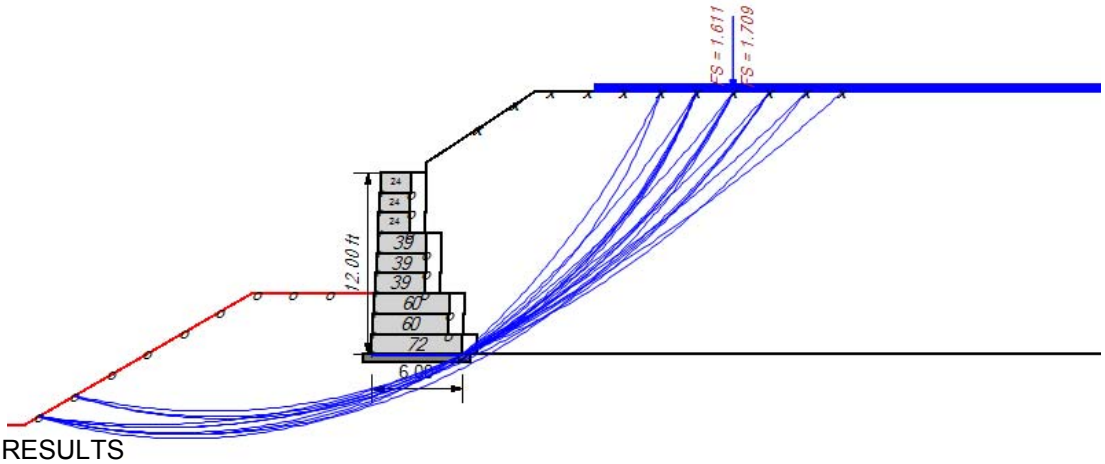
GEOMETRY

Design Height:	12.00 ft	Live Load:	250 psf
Wall Batter/Tilt:	3.58/ 0.00 deg	Live Load Offset:	12.00 ft
Embedment:	4.00 ft	Live Load Width:	50 ft
Leveling Pad Depth:	0.50 ft	Dead Load:	0 psf
Slope Angle:	33.7 deg	Dead Load Offset:	0.0 ft
Slope Length:	8.0 ft	Dead Load Width:	0 ft
Slope Toe Offset:	0.0 ft	Leveling Pad Width:	7.00 ft
		Toe Slope Angle:	30.00
		Toe Slope Length:	15.00
		Toe Slope Bench:	8.00

RESULTS

CDR Sliding:	1.02 (lvlpd)	CDR Bearing:	5.60
Eccentricity (e/L):	0.27 (e/L <= 0.33)	Bearing:	3720 / 2632 (Service)
Ecc Internal(e/L):	0.37 (e/L <= 0.45)		

Name	Elev.[dpth]	ka	Pa	Paq	Paqd	(PaC)	PaT	CDRsl(Lvl Pad)	e/L	e/L (Srvs)	%D/H
24	10.67[1.33]	0.558	69	0	0	0	69	61.53	0.03	150%	
24	9.33[2.67]	0.525	261	0	0	0	261	16.76	0.14	75%	
24	8.00[4.00]	0.492	551	0	0	0	551	8.15	0.32	50%	
39	6.67[5.33]	0.527	1050	0	0	0	1050	4.88	0.17	61%	
39	5.33[6.67]	0.495	1540	0	0	0	1540	3.47	0.26	49%	
39	4.00[8.00]	0.470	2105	0	0	0	2105	2.65	0.37	41%	
60	2.67[9.33]	0.462	2820	178	0	0	2998	2.09	0.24	54%	
60	1.33[10.67]	0.443	3526	231	0	0	3757	1.76	0.30	47%	
72	0.00[12.00]	0.437	4403	351	0	0	4754	1.02 (1.28)	0.27	50%	



COMPOUND RESULTS

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ID	Enter Point X	Enter Point Y	Exit Point X	Exit Point Y	Center X	Center Y	Radius	FoS
2	23.80	17.34	6.00	0.00	-38.59	63.59	77.67	1.709
2	26.20	17.34	6.00	0.00	-41.25	75.50	89.07	1.749
3	23.80	17.34	6.00	0.00	-11.32	35.59	39.58	1.754
2	21.40	17.34	6.00	0.00	-36.17	52.97	67.71	1.770
2	28.60	17.34	6.00	0.00	-44.12	88.74	101.91	1.771
3	26.20	17.34	6.00	0.00	-12.09	41.51	45.28	1.800
3	21.40	17.34	6.00	0.00	-10.68	30.32	34.60	1.801
2	31.00	17.34	6.00	0.00	-47.14	103.33	116.19	1.827
3	28.60	17.34	6.00	0.00	-12.95	48.11	51.70	1.829
2	19.00	17.34	6.00	0.00	-34.05	43.58	59.19	1.852

GLOBAL RESULTS

Global stability is a global analysis (Bishop) with the failure planes originating at the top of the slope / wall and exiting out below the wall in the area infront of the structure. For MSE walls, the resistance of the geogrid reinforcement is included in the analysis. The curve may go through the base of the wall and the wall shear would be included. In most cases the failure plane will pass below the structure.

ID	Enter Point X	Enter Point Y	Exit Point X	Exit Point Y	Center X	Center Y	Radius	FoS
1	23.80	17.34	-21.95	-4.05	-13.80	38.14	42.97	1.611
1	21.40	17.34	-21.95	-4.05	-12.96	32.35	37.50	1.619
1	26.20	17.34	-21.95	-4.05	-14.74	44.60	49.19	1.630
2	21.40	17.34	-21.95	-4.05	-12.64	31.71	36.95	1.632
1	21.40	17.34	-19.55	-2.67	-10.02	29.74	33.78	1.655
2	26.20	17.34	-21.95	-4.05	-13.86	42.62	47.37	1.658
1	19.00	17.34	-21.95	-4.05	-12.21	27.20	32.74	1.660
2	21.40	17.34	-19.55	-2.67	-9.76	29.21	33.35	1.669
1	23.80	17.34	-19.55	-2.67	-10.55	34.80	38.53	1.676
2	23.80	17.34	-21.95	-4.05	-12.17	34.65	39.92	1.679

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®	General •35 ft. max. height (except as noted) •Some systems not settlement tolerant
	-Redi-Rock™* -Recon™	•*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

VAOT EARTH RETAINING SYSTEM SELECTION CHART

GENERAL CLASSIFICATION	APPROVED SYSTEMS	COMMENTS
B. CUT WALLS [3]		
1. Non-Gravity Cantilevered Walls	➔ Sheet Pile Wall ➔ Soldier Pile and Lagging Wall	•15 ft max. height •Hard to drive in, dense gravel/ boulders •Vibration during driving •Large lateral movements possible
2. Anchored Walls	➔ Ground anchor (tieback) -Sheet Pile Wall -Soldier Pile and Lagging Wall ➔ Deadman anchor -Sheet Pile Wall -Soldier Pile and Lagging Wall	•65 ft. max. height •Requires specialized equipment •Underground easement required for anchors •Difficult to develop anchor capacity in loose silts and soft clays •Requires corrosion protection
3. In-situ Reinforced Walls	➔ Soil-Nailed Wall	•Soil must be self supporting for height of 5 ft. •Nails require underground easements •Not appropriate in loose silts and soft clays •Permanent dewatering required •Suited in areas with limited head space. •Wall embedment not required

Notes:

1. Fill Wall construction refers to wall systems that are constructed from the base of the wall to the top (bottom-up construction).

2. Designers should consider Reinforced Soil Slopes (RSS) in applications where steepened slopes (1 on 1) may be an appropriate alternative to a wall.

3. Cut Wall construction refers to wall systems that are constructed from the top of the wall to the base (top-down construction).

Revised: August 1, 2012

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: April 08, 2015 **PLANT:** Burlington, VT

PROJECT: **General DOT Precast - 2015**

FINE AGGREGATE: ASTM C 33	Source:	Hinesburg Sand & Gravel
	Specific Gravity:	2.68 (Abs.: 1.25%)
	Fineness Modulus:	2.65 ±
COARSE AGGREGATE: ASTM C 33	Source:	S.D. Ireland, Brownell Quarry
	Specific Gravity:	2.77(Abs.: 0.43%)
	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: 2.976)	
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)	1660	9.60
Fine Aggregate (SSD)	1198	7.17
Cement	705	3.80
Water	292	4.68
Air Content (Entrained)	6.5%	1.76
Total	3855	27.00ft³

MIX PROPERTIES/ REQUIREMENTS

Water Cement Ratios: 0.41 (0.44 max)
Entrained Air Content: 5.0 % – 9.0%
Dry Unit Weight: 143 ± pcf
Spread: 21" to 27"
Concrete Temperatures: 50 – 85°F
VSI= ≤1

ADMIXTURE(S) DOSEAGE (OZ. /YD³)

Glenium 7500 (HRWR)	46 – 53
Darex II AEA	2.0

RECENT STRENGTH GAIN

See Separate Report

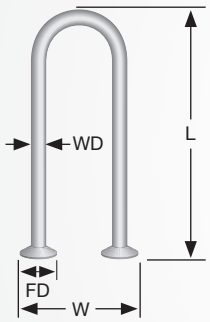
Approved by James Wild, UVM Composite Materials Engineer 4/10/15

*Admixture dosage rates are subject to change.

Patterson **3/8” x 7” R-ANCHOR**

FOR **RECON™ BLOCKS**

Fits in **Standard ReCon Steel Recess Member**

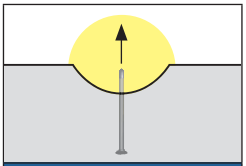


3/8” x 7” R-ANCHOR

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

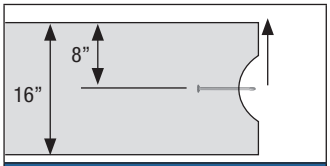
ALLOWABLE LOAD ZONE



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

Laying Down Block

ALLOWABLE LOAD ZONE

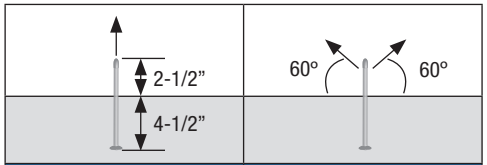


Safe Working Load 1,500 PSI Concrete 4:1 SWL (lbs)
2,195*

* 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

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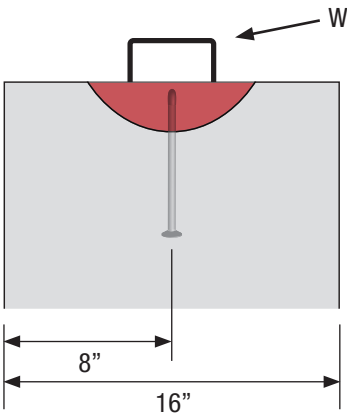
PATTERSON
Your Single Source Supplier

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

STRIPPING ANCHOR

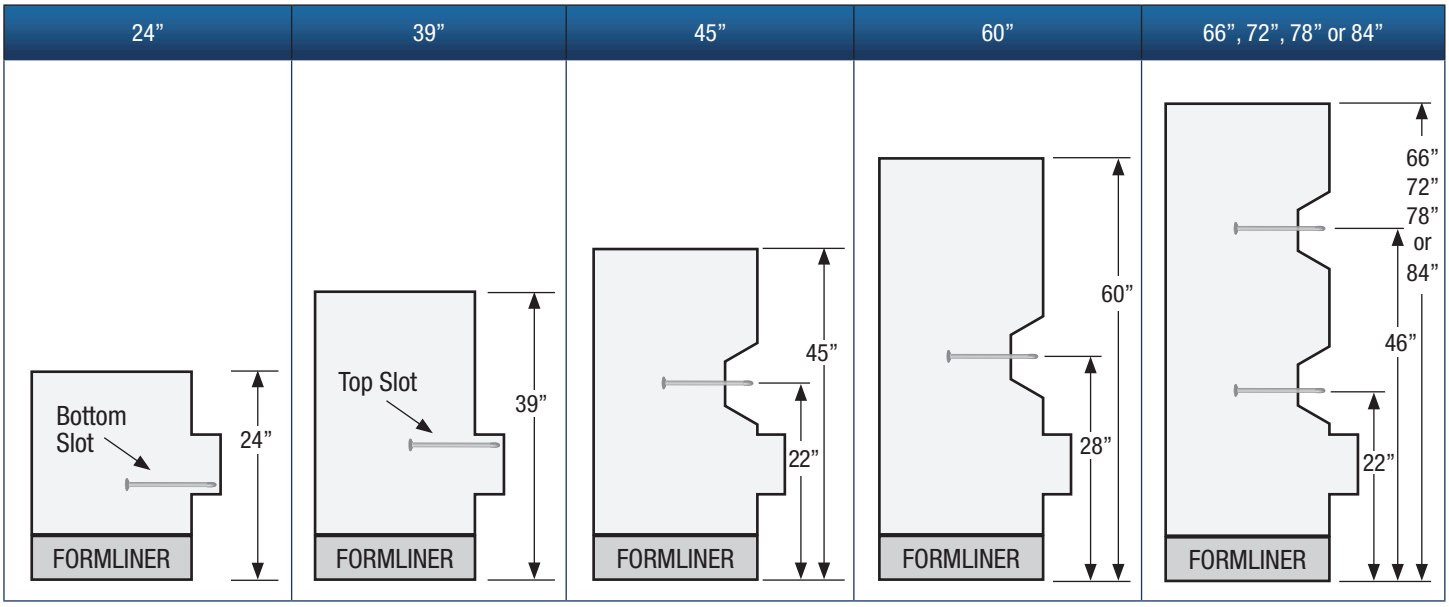


Side View

Works on 24”-84”
deep ReCon Blocks

SETTING ANCHOR

BLOCK DEPTH



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Required Stripping Strength

Block Dimensions / Weight				Block Placement Anchor…Used in the Field to Place the Block in the Wall						Block Stripping Anchor: (a) Used in the Production Facility to Strip the Block from the form, and (b) to then lay the block down on its side.		
Face Width	Face Height	Block Depth	Approx. Weight of Block (Base Block Weights)	Block Placement Lifting Anchor Position…Distance measured from front face of Block	Number of Block Placement Anchors	Anchor at Center of Gravity Point?	Proposed Anchor	Embedment Depth	Minimum Concrete Strength at time of handling in Production Facility	Proposed Anchor	Embedment Depth	Minimum Concrete Strength at time of handling in Production Facility
48	16	24	1488	11 7/8	1	Yes	3/8 X 7 R Anchor	Not Recessed, 4 3/4" embedded	1500	3/8 X 7 R Anchor	Not Recessed, 4 3/4" embedded	1500
48	16	39	2278	17 1/4	1	Yes	3/8 X 7 R Anchor	Not Recessed, 4 3/4" embedded	1500	3/8 X 7 R Anchor	Not Recessed, 4 3/4" embedded	1500
48	16	45	2568	22	1	Yes	3/8 X 7 R Anchor	***Recessed 7"***	1500	3/8 X 7 R Anchor	Not Recessed, 4 3/4" embedded	1500
48	16	60	3192	**11 7/8 & 46**	**2**	No	3/8 X 7 R Anchor	***Front Anchor embedded 4 3/4", Rear Anchor Recessed 7"***	1500	3/8 X 7 R Anchor	***Recessed, 7" embedded***	1500
48	16	66	3434	22 & 46	2	No	3/8 X 7 R Anchor	***Recessed 7"***	1500	3/8 X 7 R Anchor	***Recessed, 7" embedded***	1500
48	16	72	3677	22 & 46	2	No	3/8 X 7 R Anchor	***Recessed 7"***	1500	3/8 X 7 R Anchor	***Recessed, 7" embedded***	1500
48	16	78	3920	22 & 46	2	No	3/8 X 7 R Anchor	***Recessed 7"***	1500	3/8 X 7 R Anchor	***Recessed, 7" embedded***	1500
48	16	84	4162	22 & 46	2	No	3/8 X 7 R Anchor	***Recessed 7"***	1500	3/8 X 7 R Anchor	***Recessed, 7" embedded***	1500

Notes:

1. When handling blocks with a chain, one block at a time is the limit. The hook that is used must fit into the anchor / loop "freely". It MUST NOT be forced or wedged into the loop and the hook MUST NOT be touching the concrete surface. If the hook is wedged into the loop or is in contact with the concrete sruface of the block, it will create an additional force or prying effect on the loop which the loop is not designed to accomodate.
2. When placing a ReCon Block in the field that uses TWO anchors for placement (60", 66", 72", 78" and 84" deep blocks), the chains or cables used when linked together with a single "ring" must have a length on each leg of the chain such that the angle of the chain from the horizontal surface of the block is 60 degrees or more. This would make the chain at least 48" in length.
3. When placing a ReCon Block in the field that uses TWO anchors for placement (60", 66", 72", 78" and 84" deep blocks), the chains or cables used must be rated to safely list the weight of the block PLUS an additional 40% of the weight of the block (given the shear forces at work between the two pick points) with a factor of safety of 5:1.
4. When a block 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” that will absorb and reduce the dynamic loads. Keep the swinging and bouncing of the block to an absolute minimum. Move slowly during such transport.
5. If using a rigid “picking device” fixed to the front of a skid steer, care should be taken to make sure that the hook on the end of the picking device is resting freely in the lifting anchor / loop and that the skid steer operator does NOT tip the block back so that the picking device is “prying up” on the anchor, applying more force to the anchor than the force that would exist if the block was hanging freely.
6. Hot tipped galvanized anchors recommended.

Summary of Stork Testing for the R Anchor

Conac Sponsered Testing dated 8/31/2010.

A.L. Patterson Sponsered Testing dated 11/10/09, 4/18/2011, and 4/22/11 (Blue Ridge Design, Inc.).

Test reports available upon request from ReCon Wall Systems, Inc.

recon™ Retaining Wall Systems

Summary of Lifting Anchor Positions for ReCon Full Block

Ph: 952-922-0027 Fax: 952-922-0028

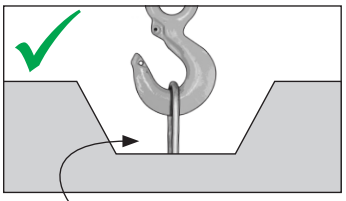
Web: www.reconwalls.com

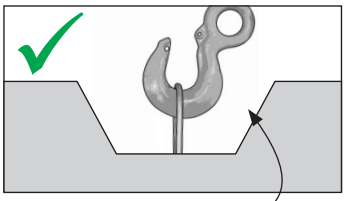
Date Prepared: 10/17/11

Date Revised: 9/11/12

3/8” R-Anchor Safety Guide for ReCon™ Retaining Walls

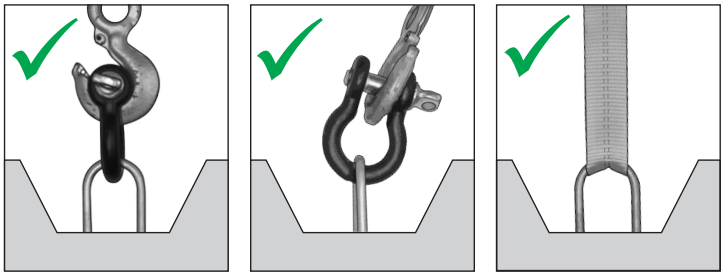
ACCEPTABLE LIFTING PRACTICES ✓





Hook **must not** touch **ANY** concrete surfaces

OPTIONS FOR OVERSIZED HOOKS

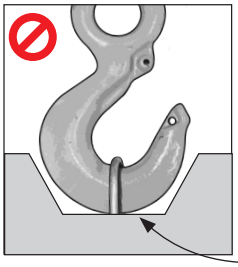


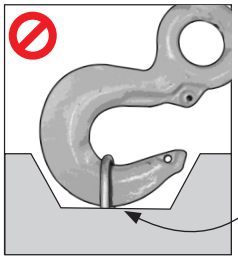
All lifting hooks and components should exceed Safe Working Load (SWL) of the block.

PROPER HANDLING:

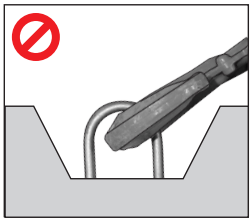
- Anchor is engaged in smooth/ consistent motion
- Only transport block on flat/ even surfaces
- Utilize rigging designed to absorb impact loading (Use cables as opposed to chains)

UNACCEPTABLE LIFTING PRACTICES ⊘

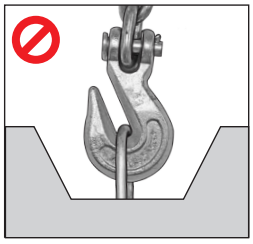




Hooks should **NEVER** be wedged between anchor and concrete surface. **This could lead to anchor failure.**



NEVER pull sideways on the anchor. **This reduces anchor capacity.**



NEVER use grab hooks to engage R-Anchor. **This could lead to anchor failure.**

AVOID:

- Moving block across uneven ground using lifting anchors
- Sudden/jerky movements
- Sliding block across ground
- Using chains, they transfer impact loads to anchor

(800) 332-7090
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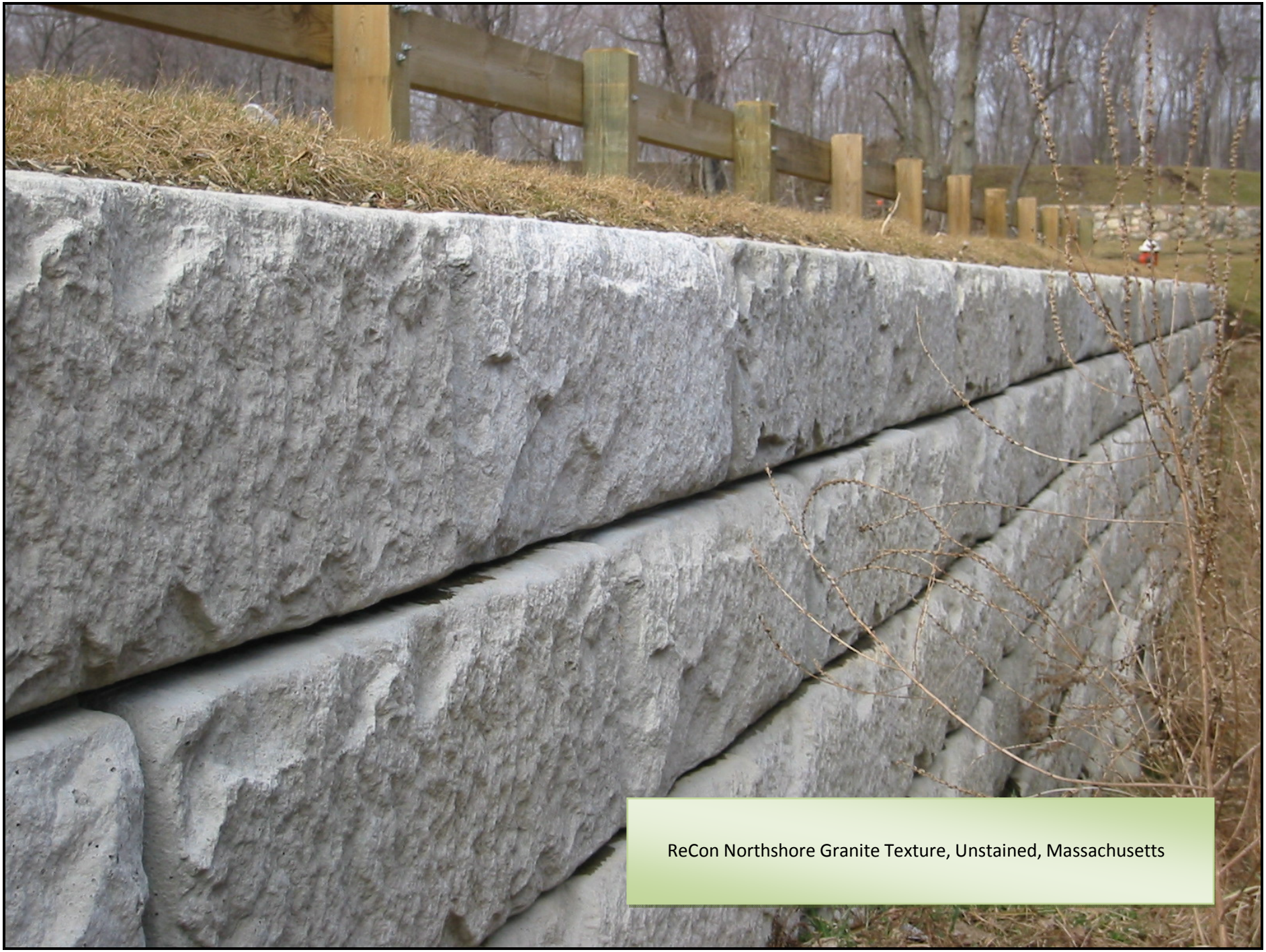
ReCon Texture Choices…Northshore Granite

Aesthetics You Want…Performance You Need!

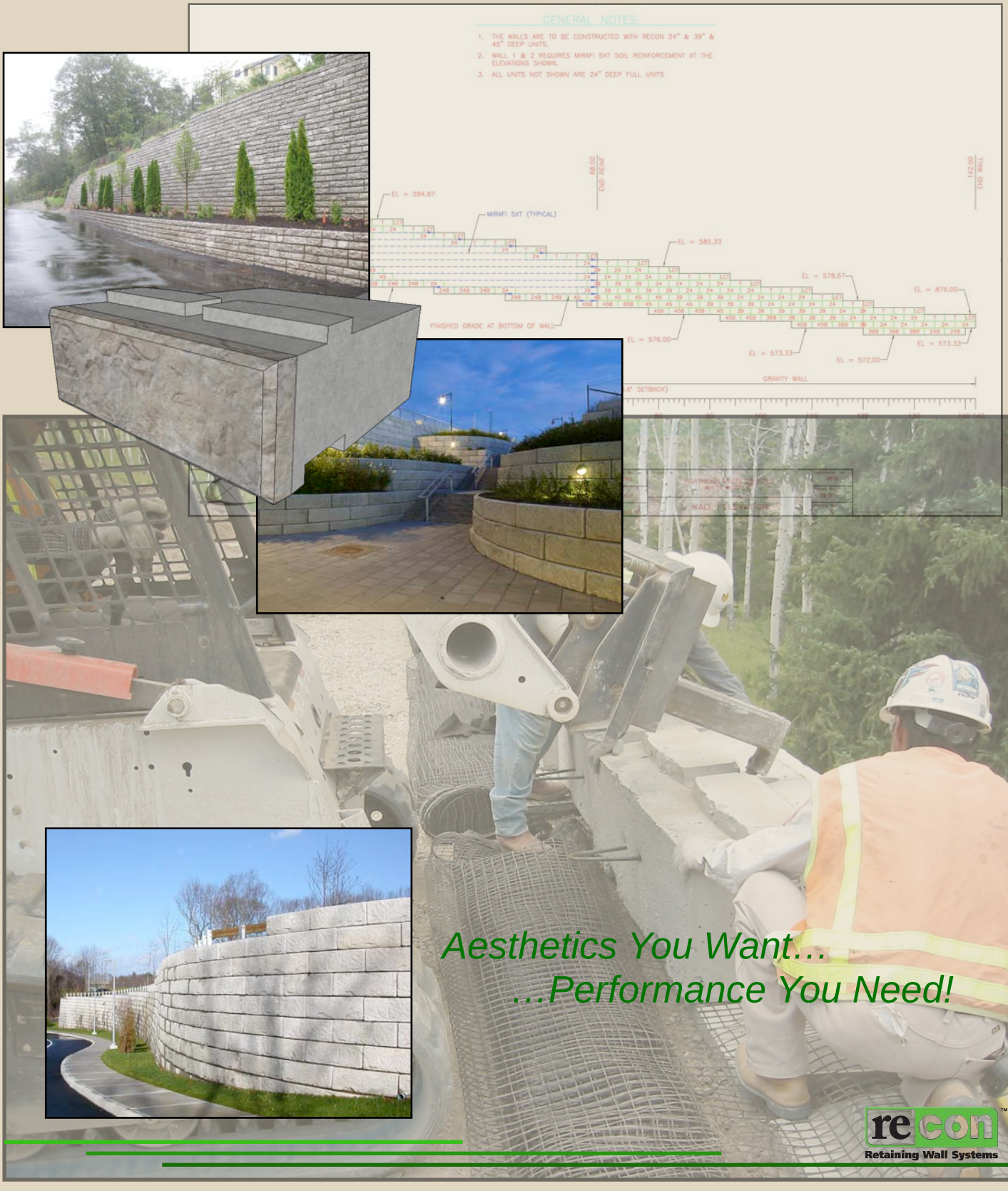
Retaining Wall Systems
7600 West 27th St., #229
St. Louis Park, MN 55426
www.reconwalls.com
Tel: +1 952 922 0027
Fax: +1 952 022 0028



ReCon Northshore Granite Texture, Unstained, Massachusetts

Design and Construction Reference Manual

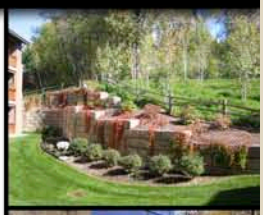
ReCon Series 50



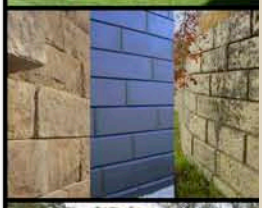
recon
Retaining Wall Systems

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

Scale...
Each block really is a block



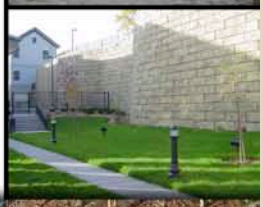
Texture...
Not one choice, but three

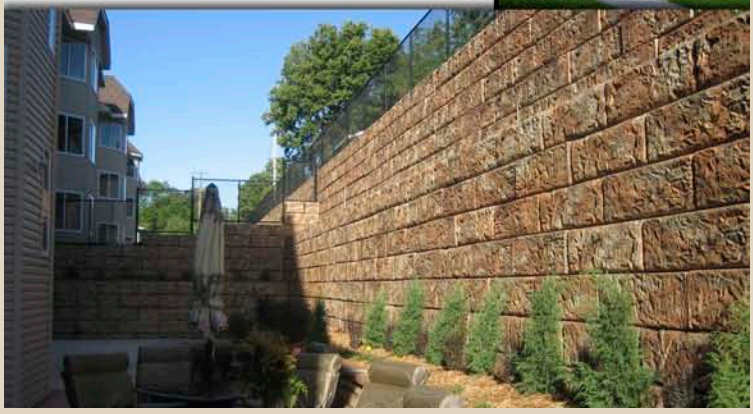


Shapes...
Flexibility and choices that work

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

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



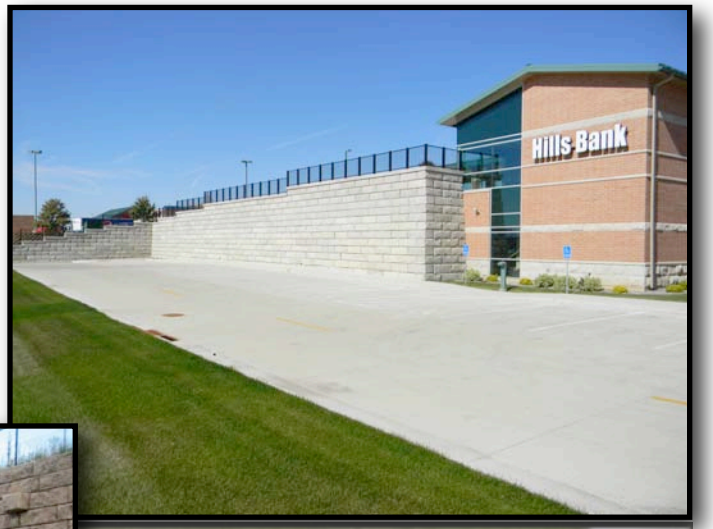


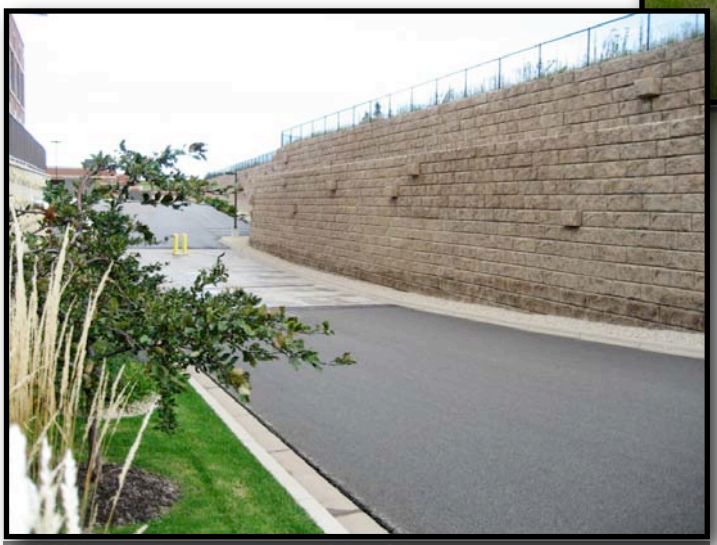
www.reconwalls.com

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

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°

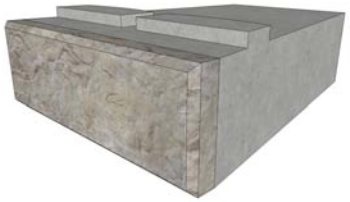
Name Full Base Block - 60”, 66”, 72”, 78”, 84”

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°



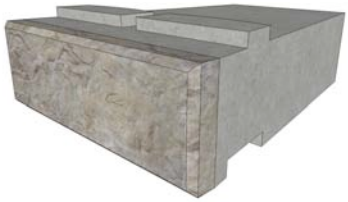
Name Full Middle Block - 60”, 66”, 72”, 78”, 84”

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°

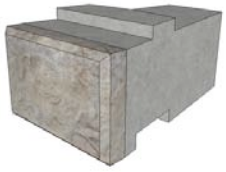
Name Half Middle Block - 39”

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°

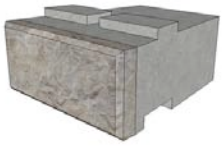
Name Three Quarter Block - 39”

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

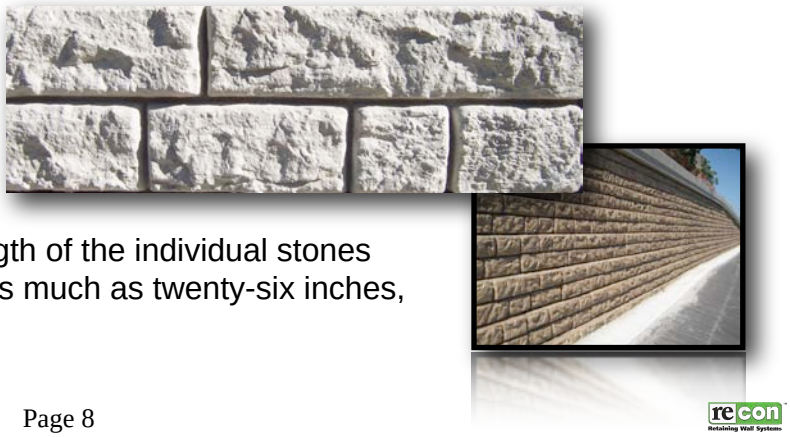
Granite may be the most universally recognized natural stone on earth. While its coloration varies widely, the texture of an unprocessed granite is somewhat consistent in the way it fractures due to its composition and density. Stained or unstained, the appearance of North Shore Granite can be nearly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

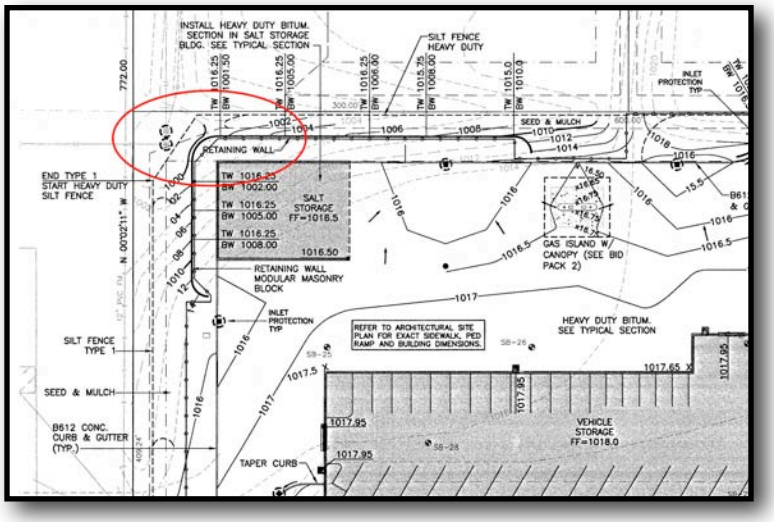
The Rustic Stone texture captures the authenticity of a natural weathered cut stone that has been stacked in eight-inch coursing. The length of the individual stones varies from as little as eight inches to as much as twenty-six inches, resulting in a natural random pattern.



Design Parameters

Wall Geometry

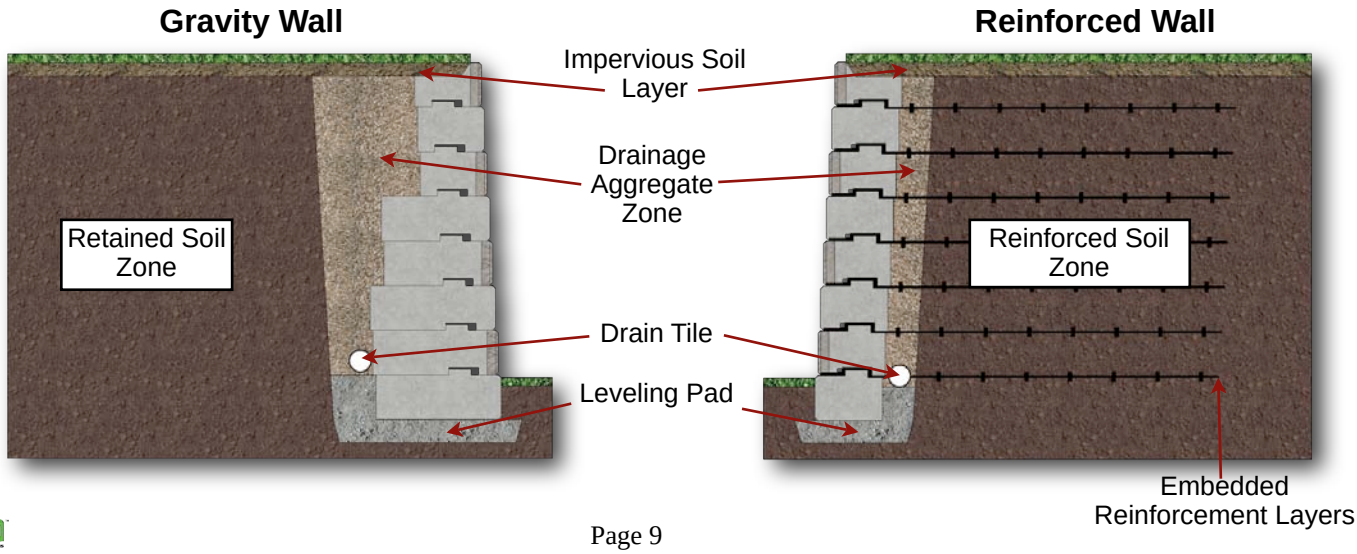
When planning a ReCon retaining wall, the most logical place to start is the wall location and where it resides with reference to the project site and topography. For most commercial projects this information is usually found on the site-grading plan. A great deal of the information necessary to properly 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.

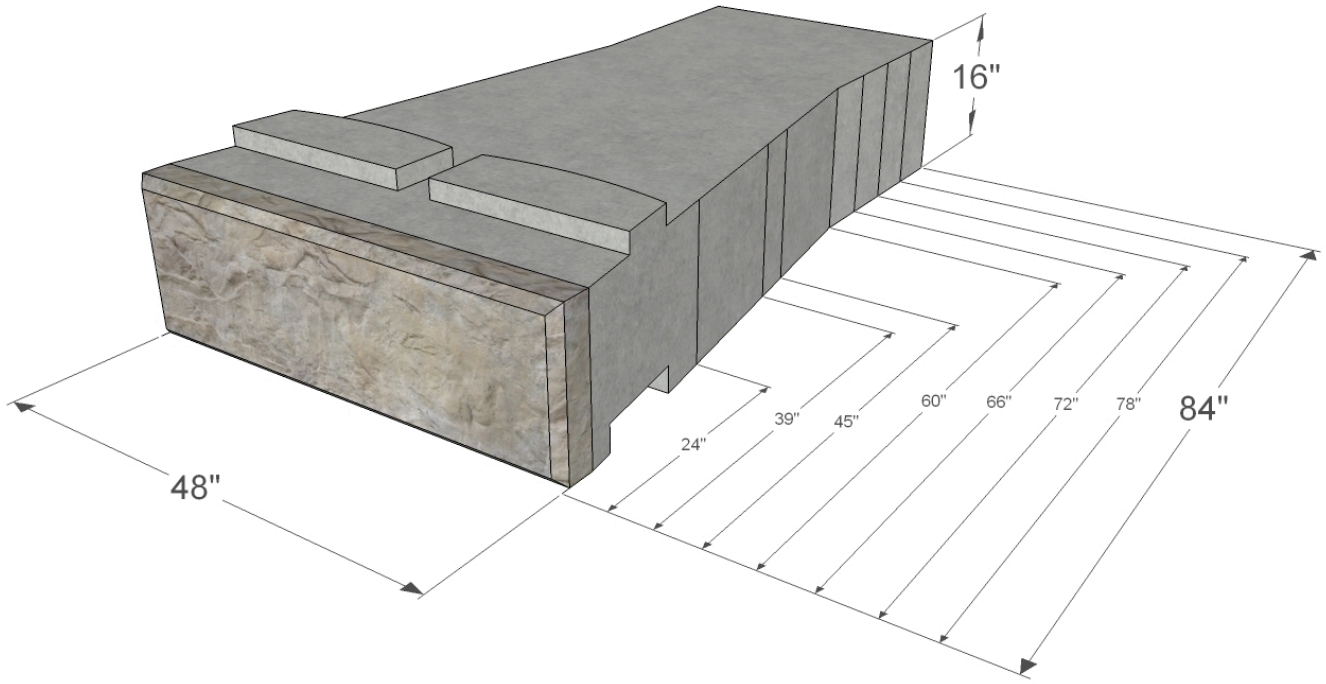
1.Dimensions
- A.Height
- B.Width
- C.Depth

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°

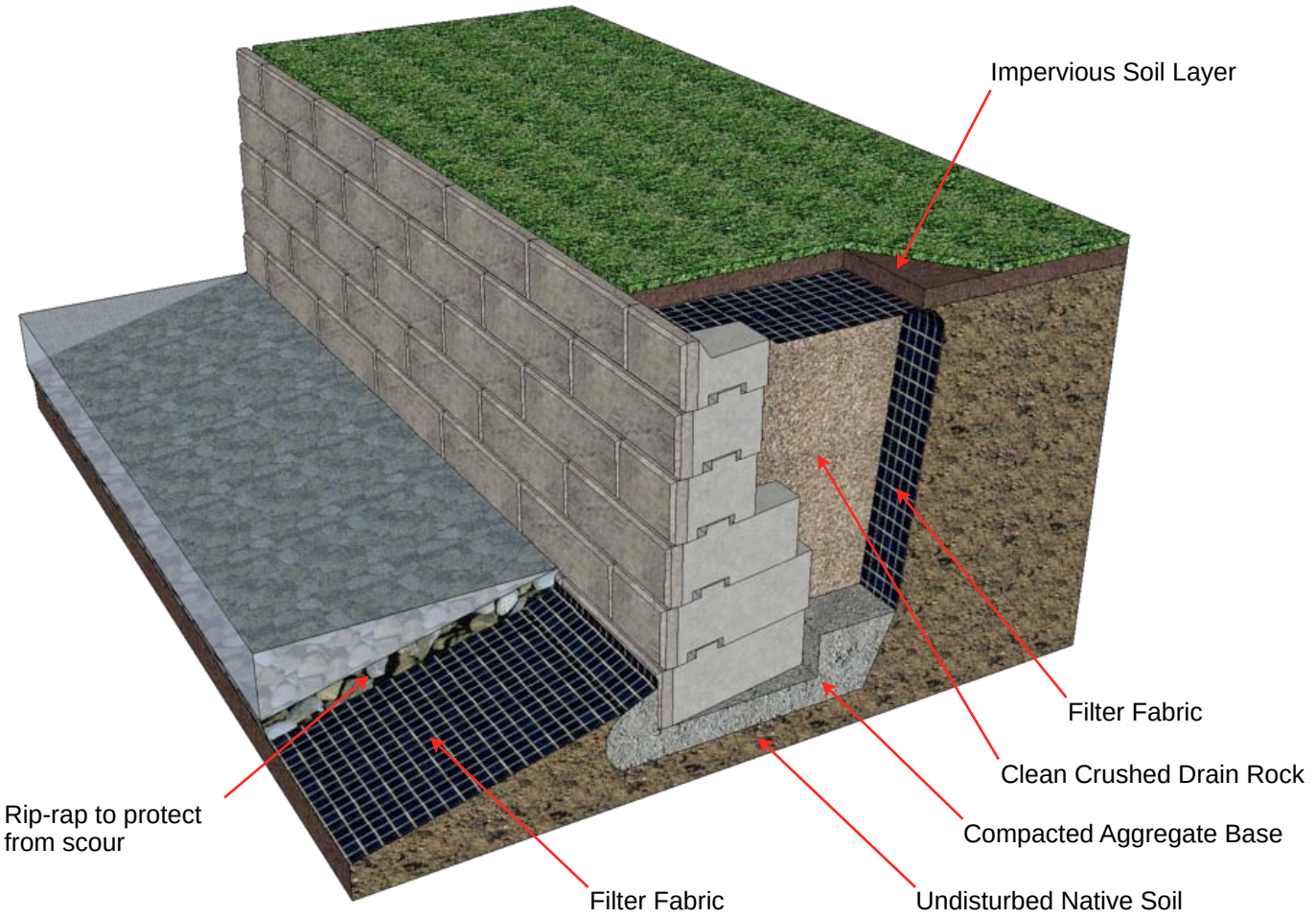
Water / Drainage

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.

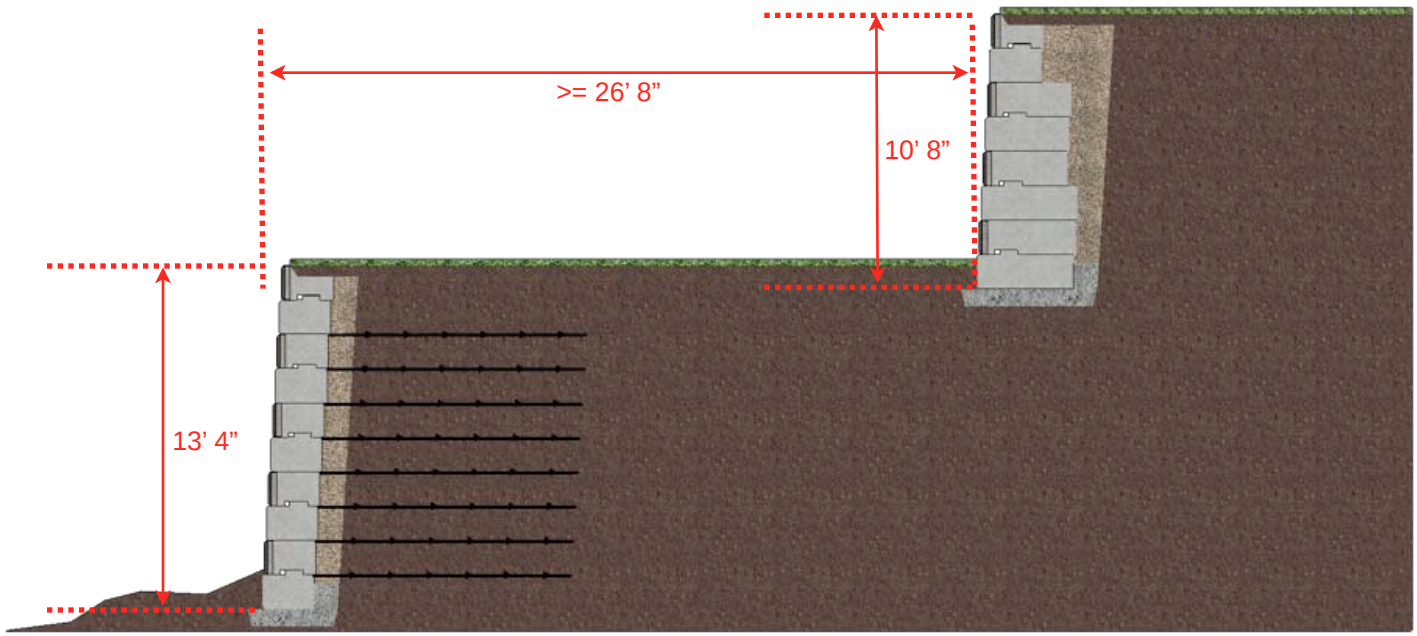
Most terraced walls may be considered independent of each other if they meet the requirements of the following rule of thumb.

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.

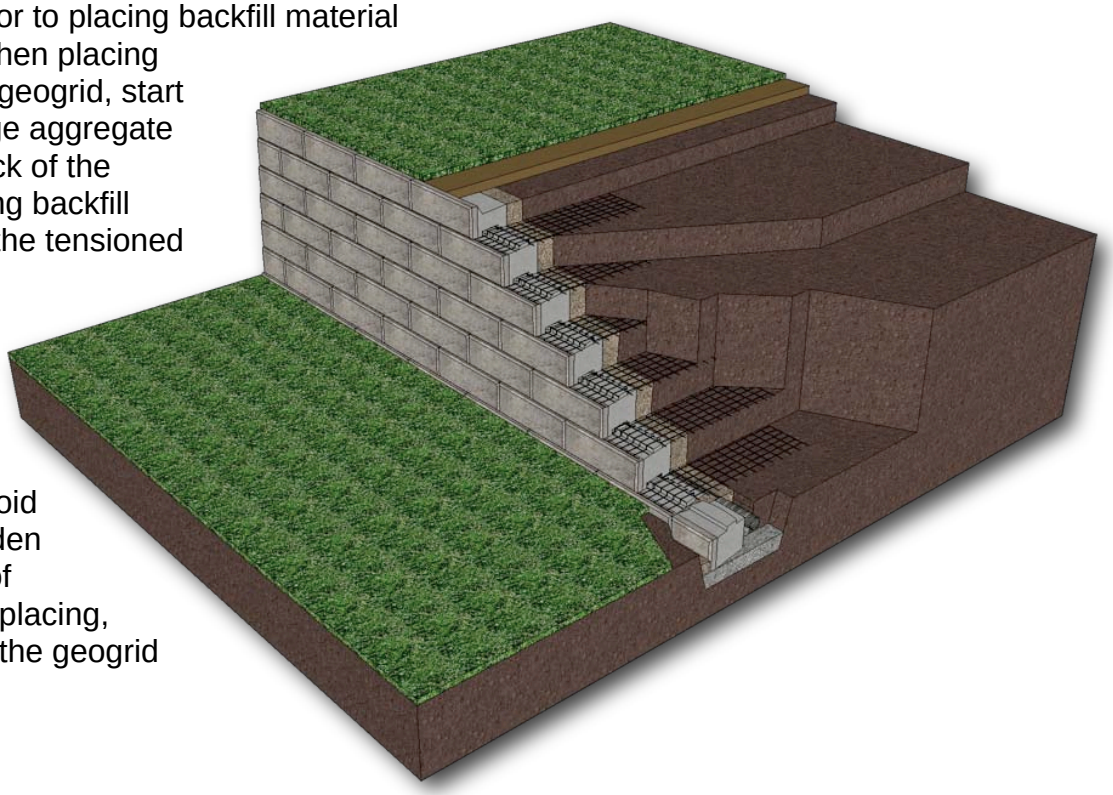
Place the specified backfill material and thoroughly compact material in 8" lifts. Backfill material should be compacted to 95% of standard proctor. **Improper or inadequate compaction is a primary source of contractor-caused wall failures.** Close attention should be paid to changes in consistency and 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.



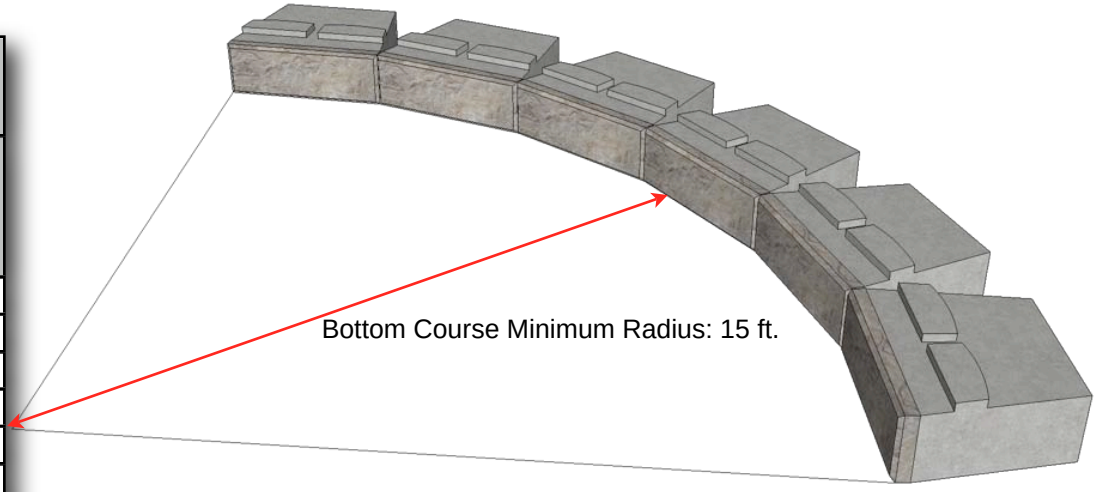
Curved Walls

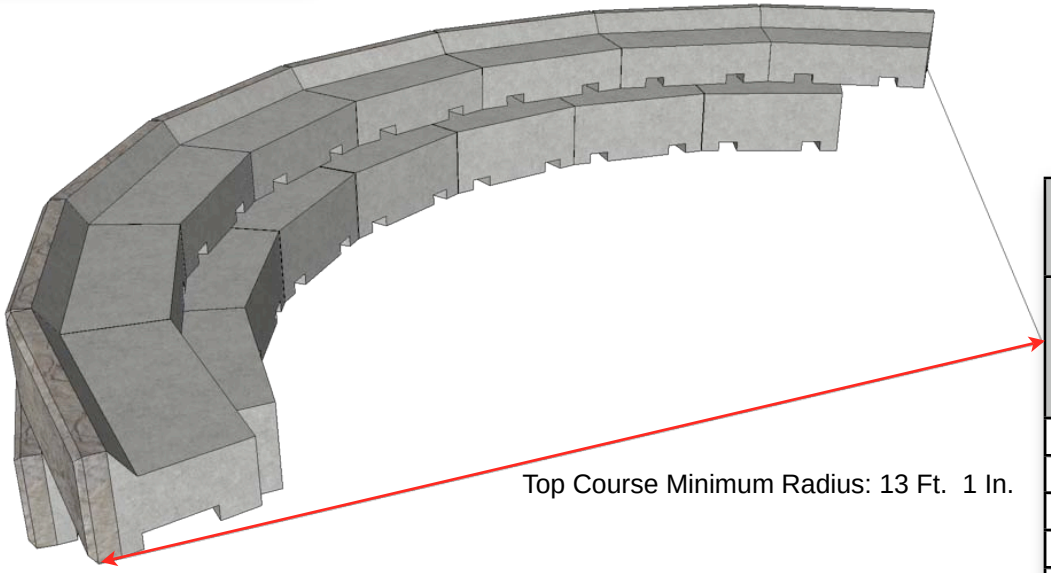
The absolute minimum turning radius for ReCon “Series 50” units is a little over 13’. Due to the integral setback of the units, the actual minimum radius grows or shrinks by 2” or so for each additional course… depending on whether it is an “inside” or “outside” curve in the wall. For ease of installation, 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”





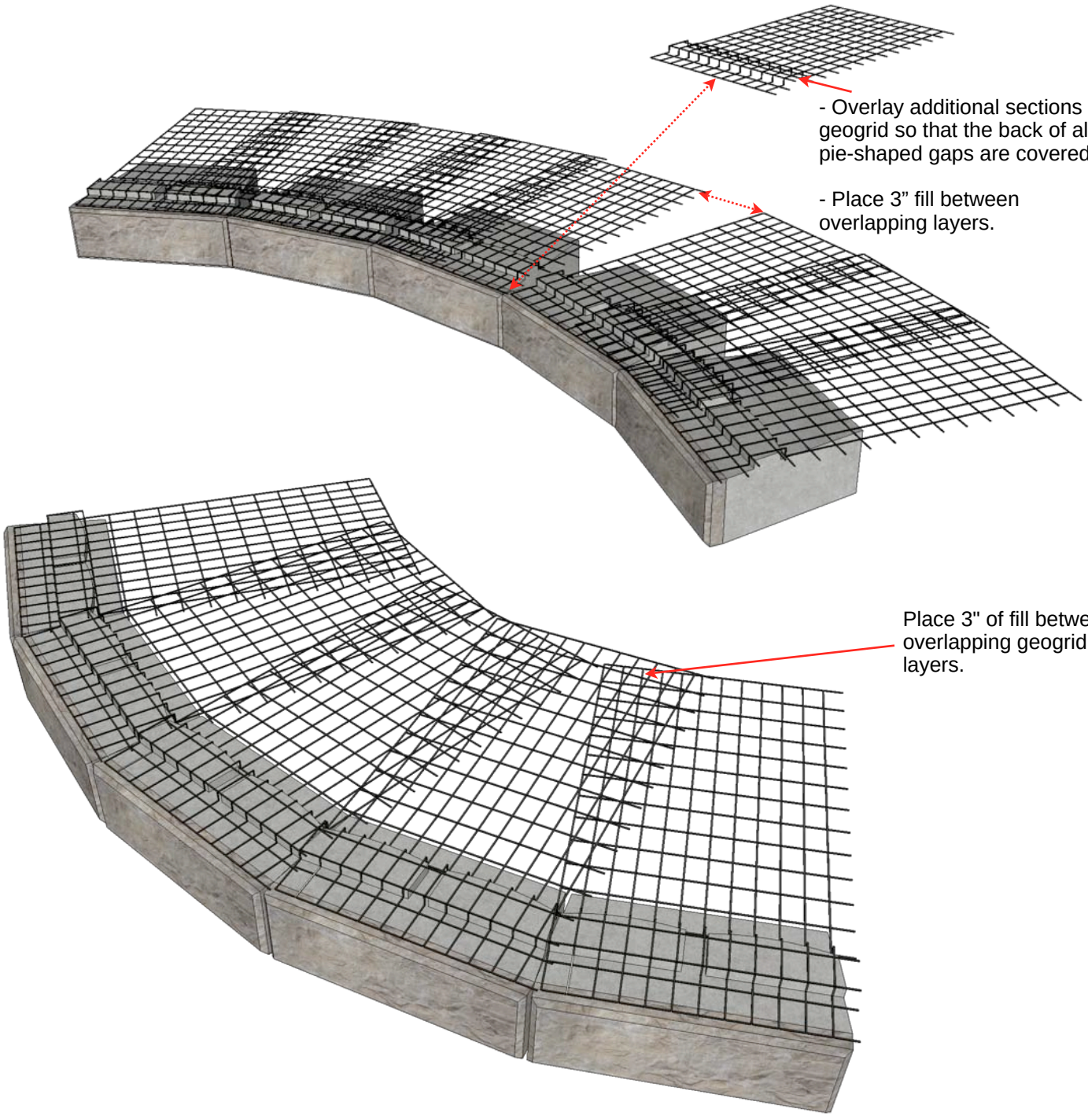
Outside Curve Minimum Radius

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

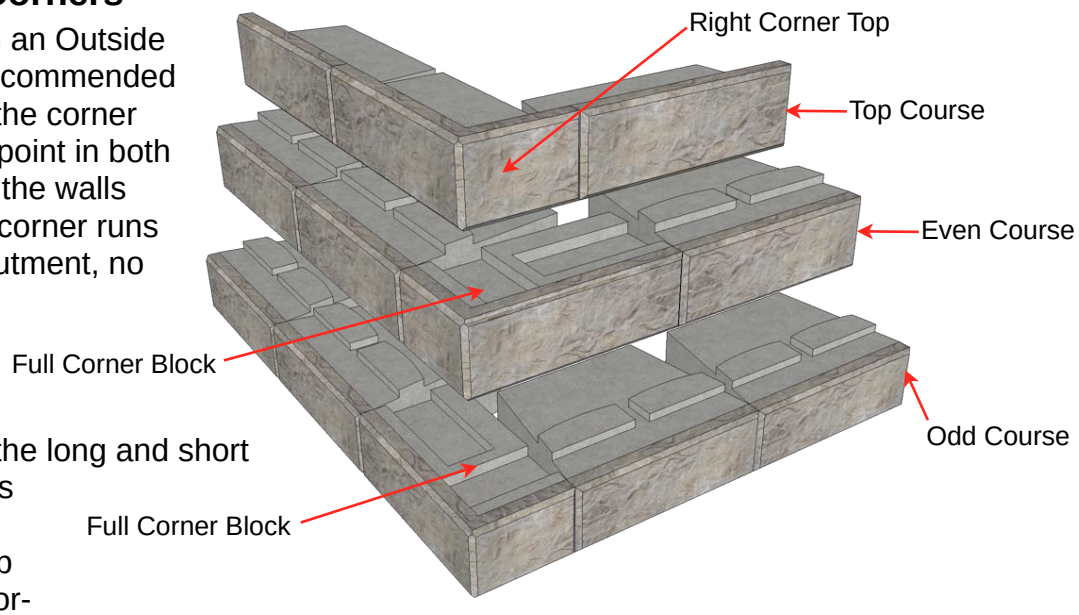
Most accepted design methodologies stipulate that the reinforcement shall be continuous along the length of the wall at both the front and rear of the reinforced soil zone. Geogrid layers should not overlap unless there is compacted soil separating the individual layers. In addition, the natural rectangular 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.



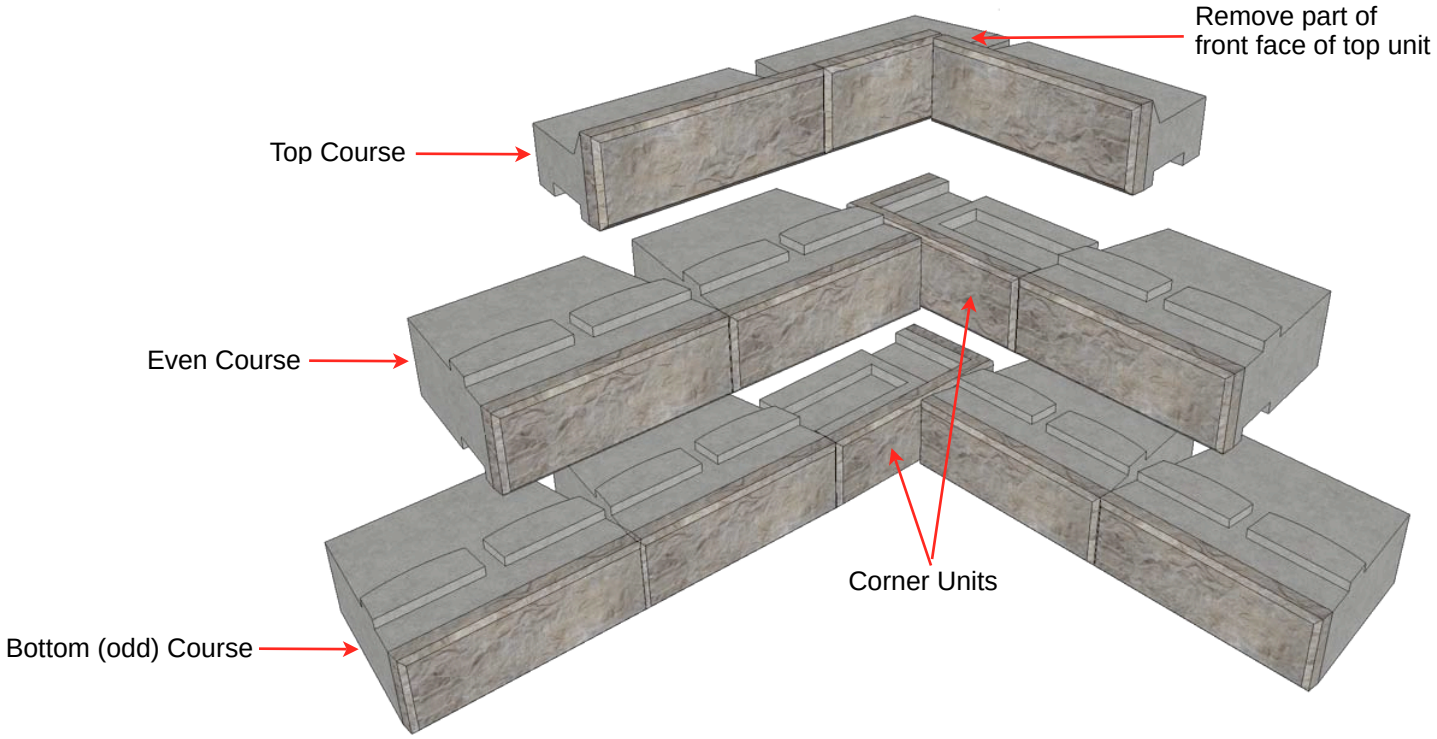
Outside 90 Degree Corners

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.



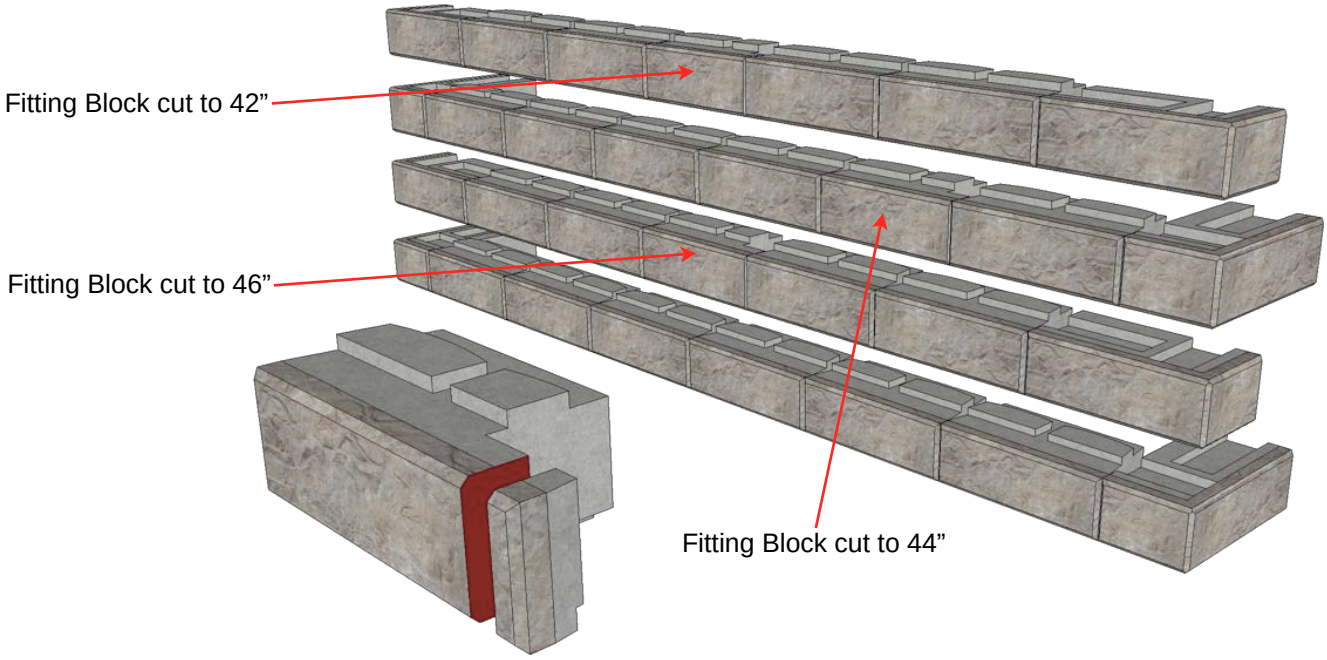
Inside 90 Degree Corners

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.



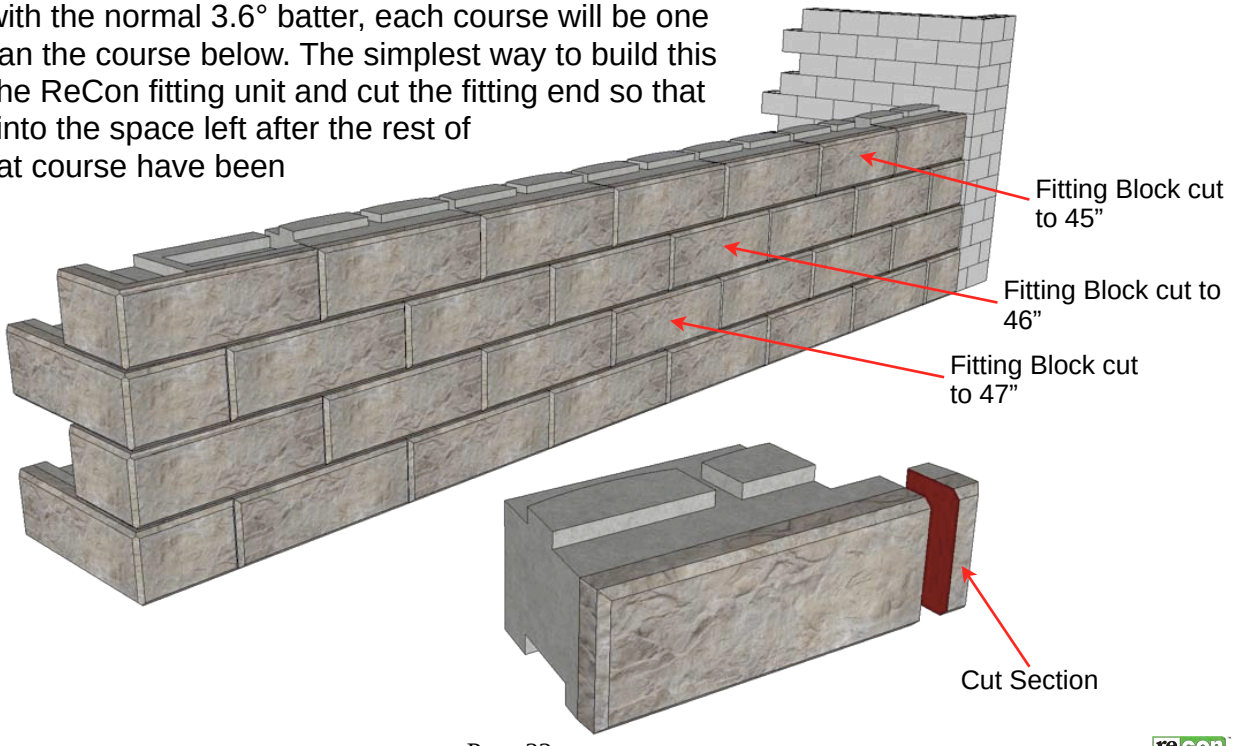
Double Outside 90 Degree Corners

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

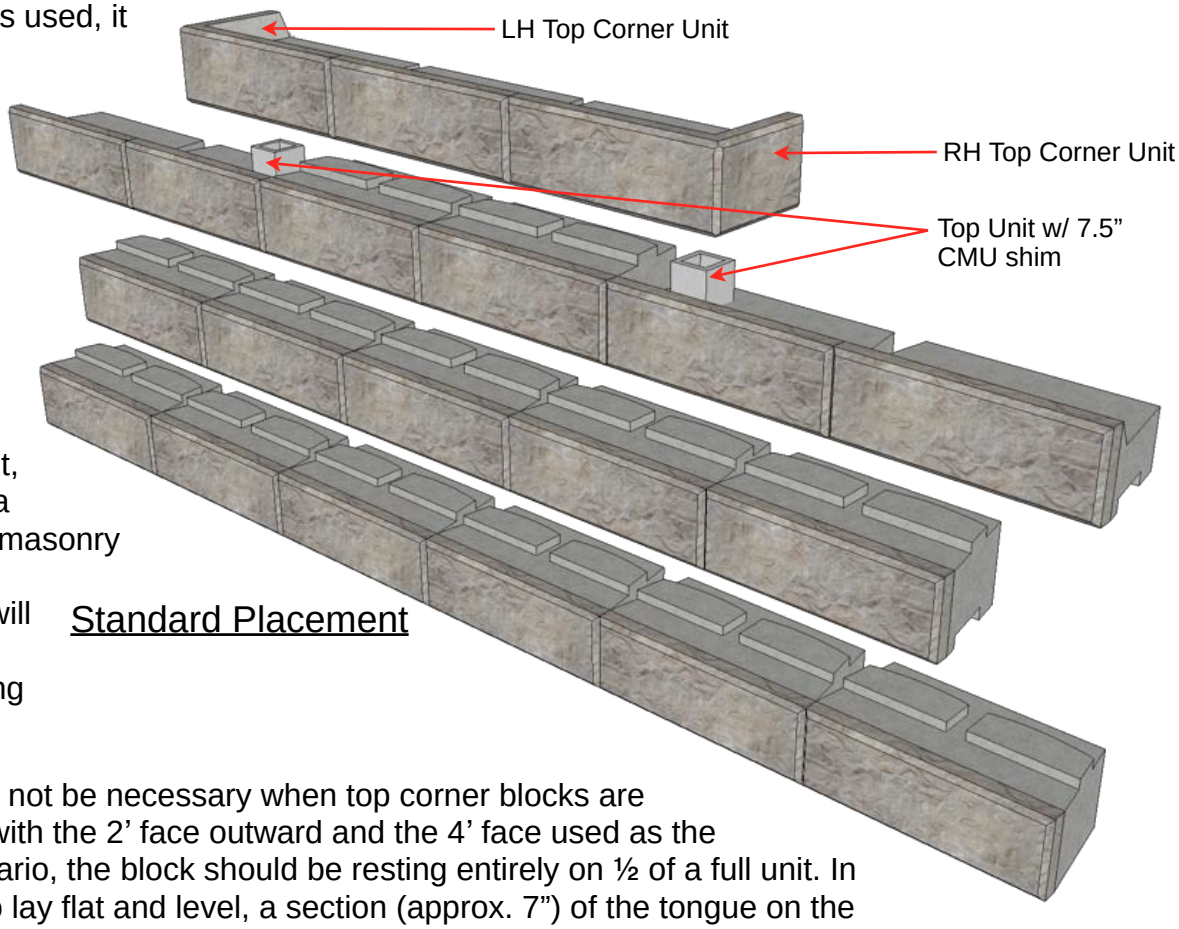
The tops of ReCon walls are usually either capped using ReCon “Series 50” cap units or finished with top block units. Other treatments typically involve special construction, such as forming and pouring a concrete parapet or attaching specialty, precast components.

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.

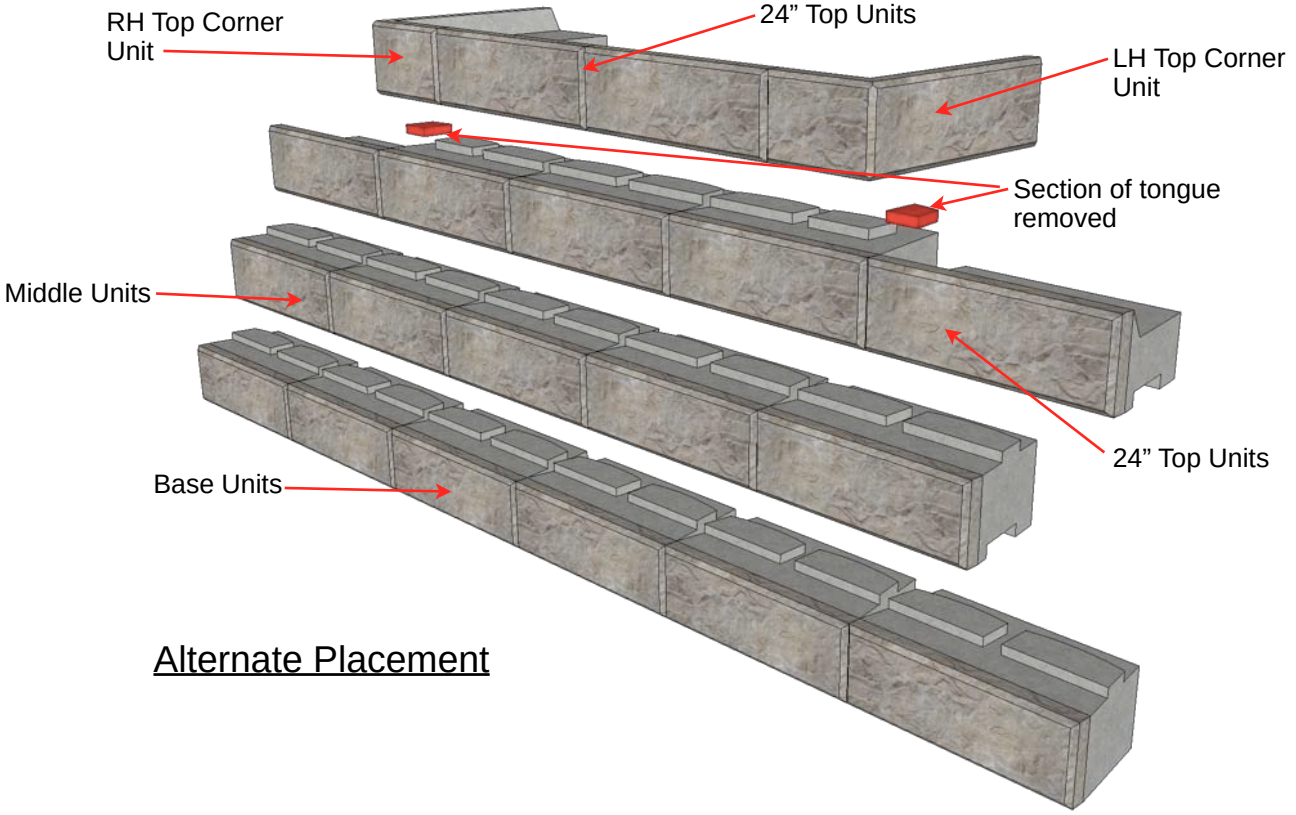
If it is desired that the 4’ face returns back into the retained soil, then a left corner top block will actually return (with respect to the wall face) on its right side and visa-versa for a right corner top block. This is referred to as “alternate” placement.

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.



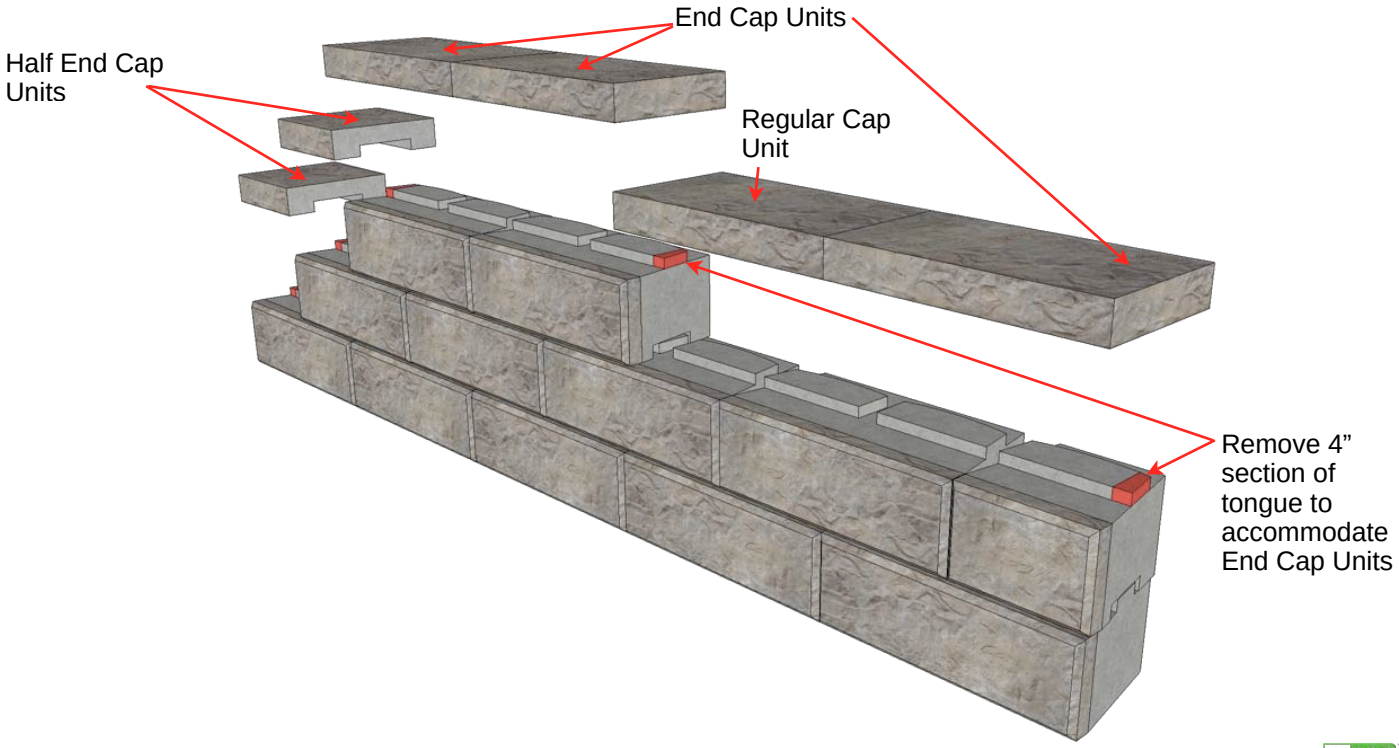
Standard Placement

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.



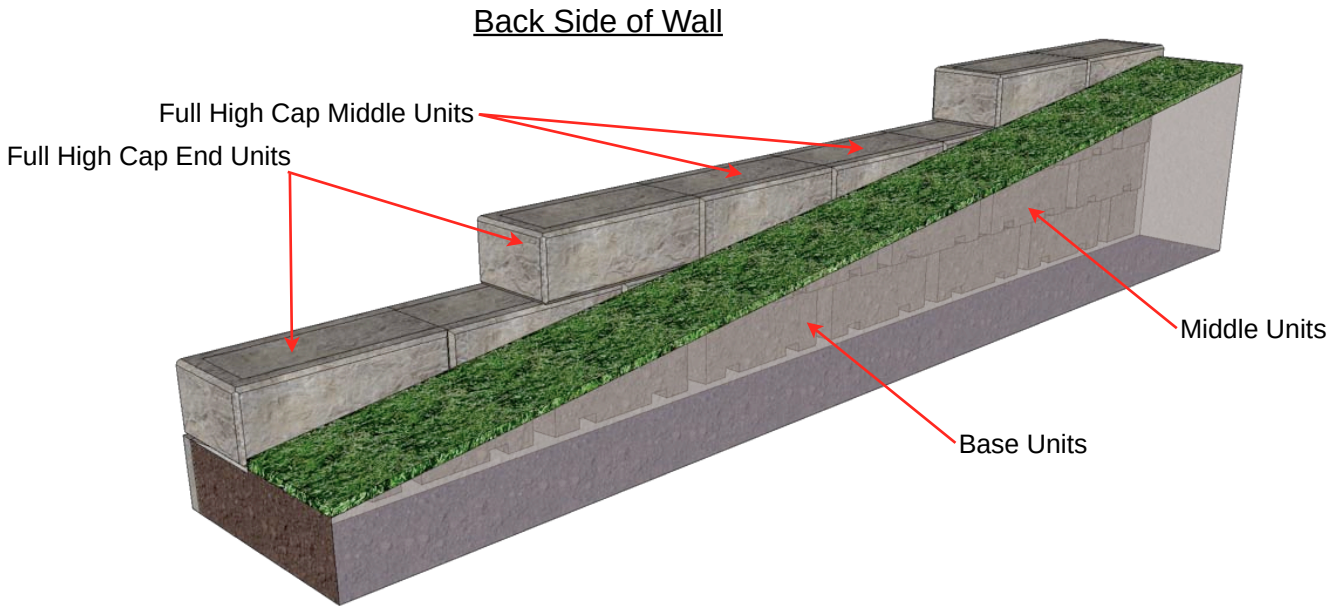
Cap Units

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.



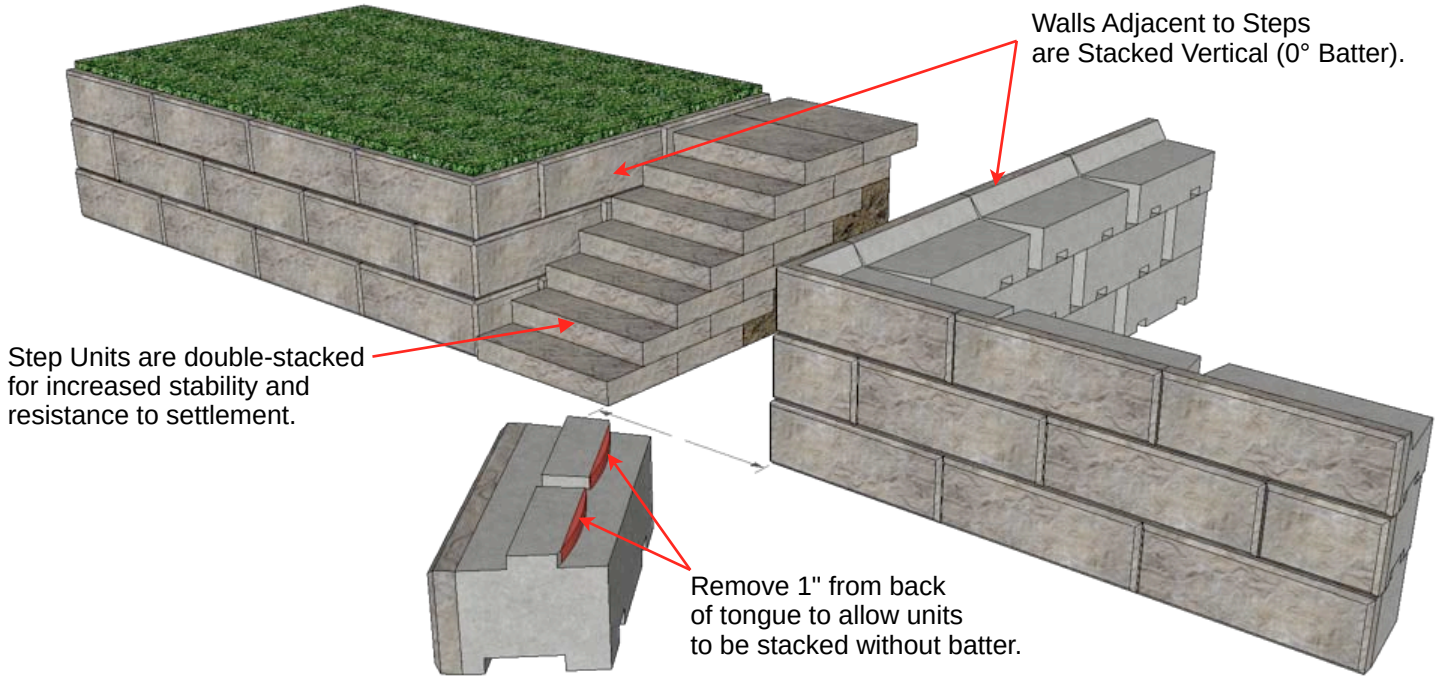
Full-High Cap Units

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.



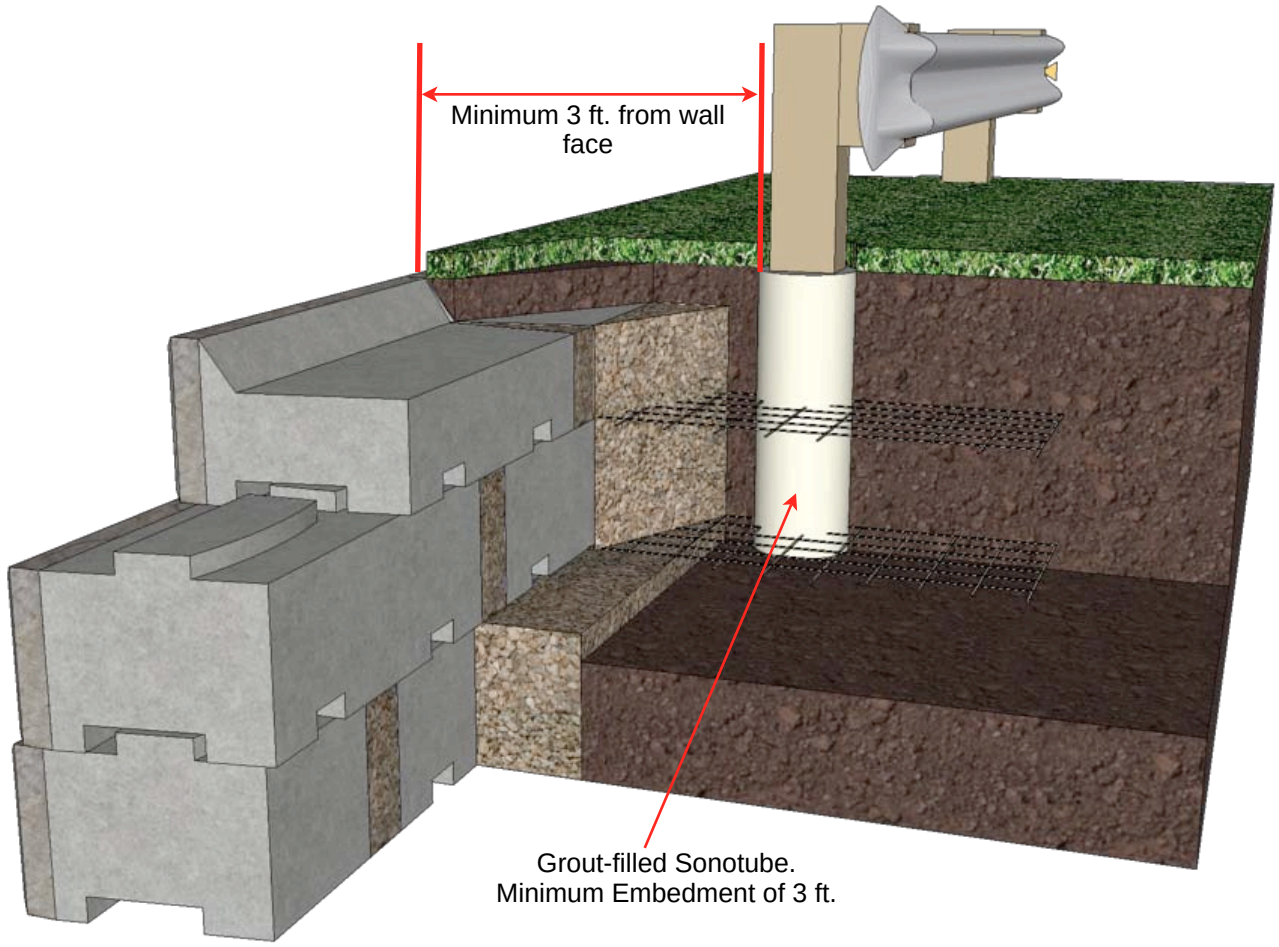
Steps

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

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.

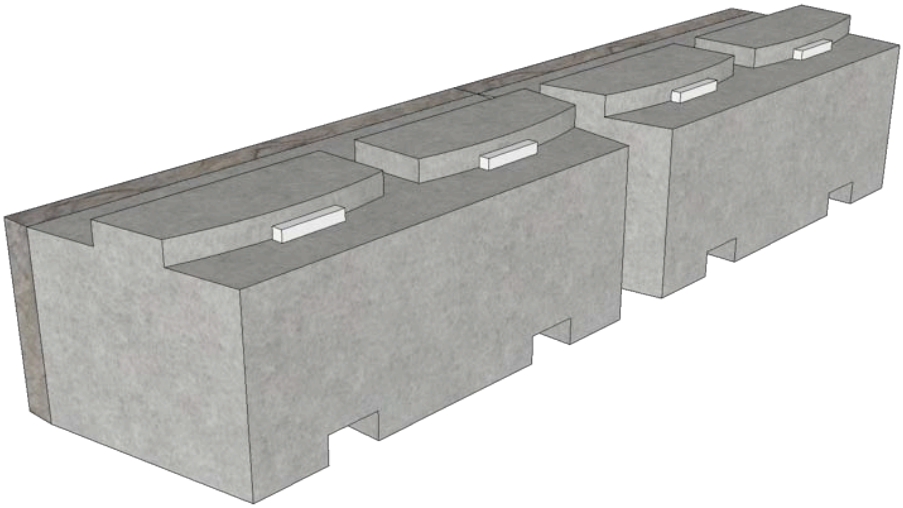
3.12. STAINING / SEALING (Optional)

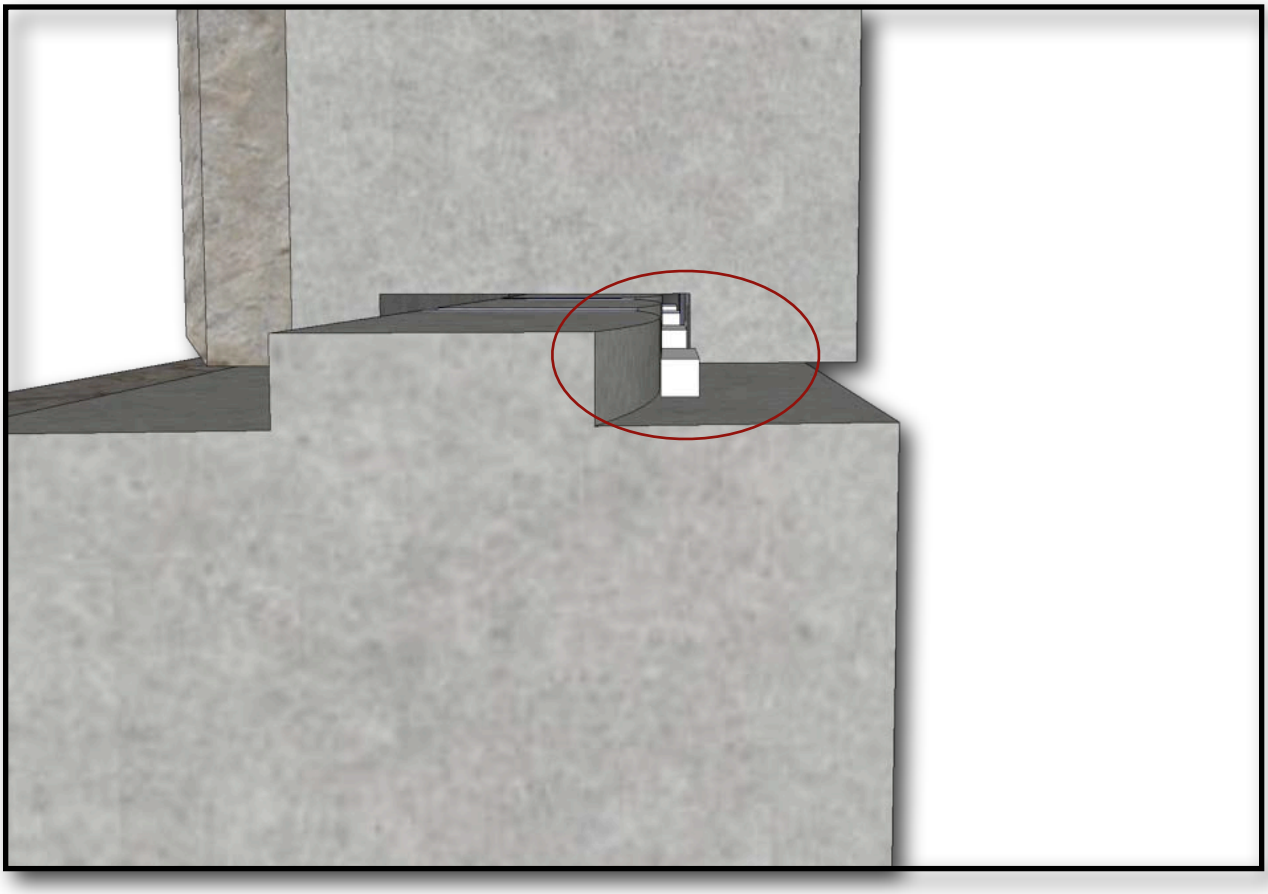
A. Provide samples of stained / sealed faces for approval prior to commencing application to ReCon retaining wall units. Samples shall be large enough to demonstrate scope of color variation.

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

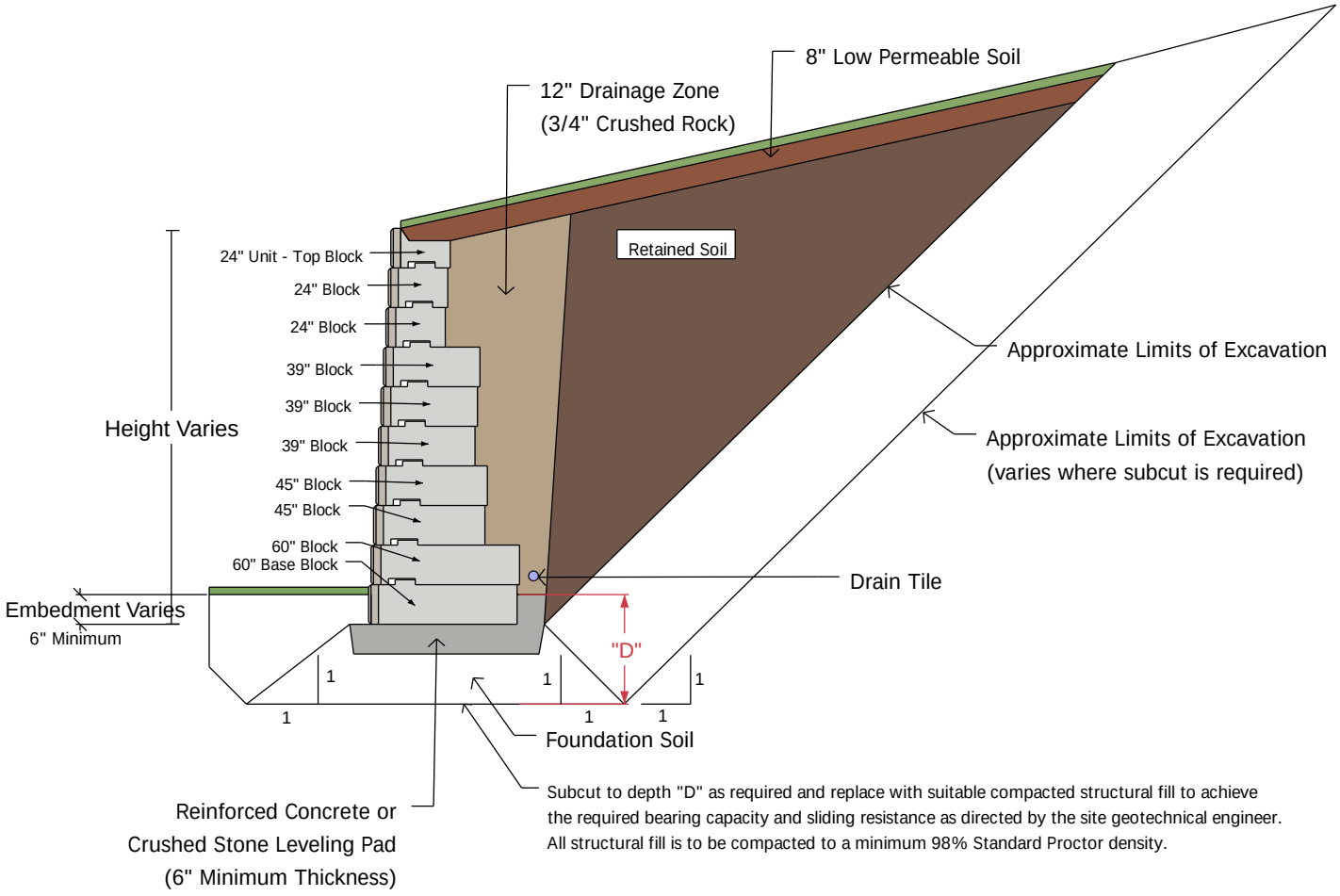
Increasing Gravity Wall Heights

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

Batter	LEVEL BACKSLOPE			250 PSF SURCHARGE†			3H:1V BACKSLOPE††		
		3.6°	7.2°		3.6°	7.2°		3.6°	7.2°
Soil Phi Angle	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.)
Silt/ Lean Clay 26°	**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						

Batter	LEVEL BACKSLOPE			250 PSF SURCHARGE†			3H:1V BACKSLOPE††		
		3.6°	7.2°		3.6°	7.2°		3.6°	7.2°
Soil Phi Angle	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.)
Sand/ Gravel 34°	**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.

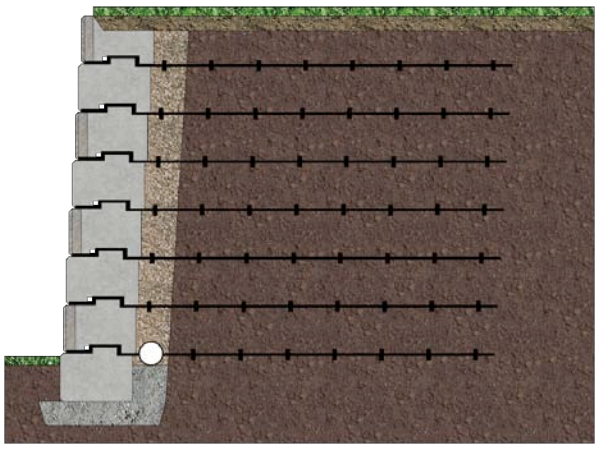
ReCon Series 50 Standard Design Charts

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'



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Notes:

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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.

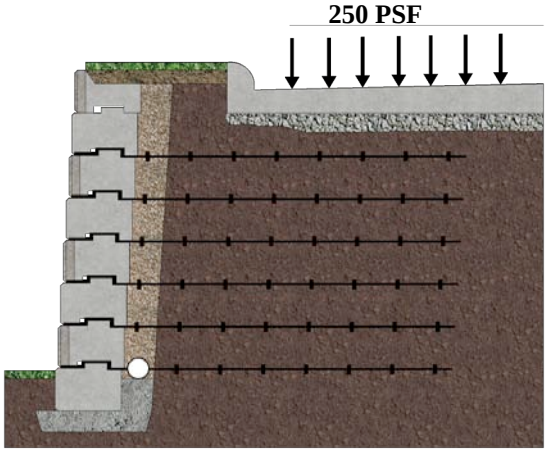
ReCon Series 50 Standard Design Charts

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'



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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’									
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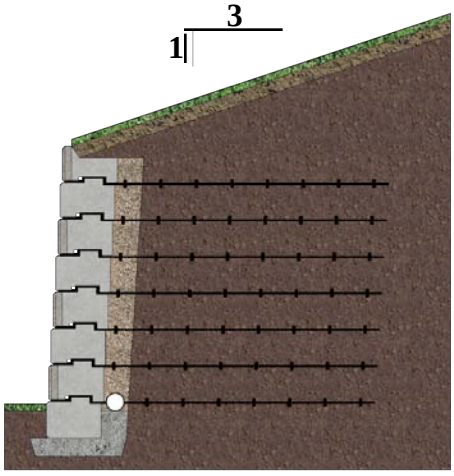
	12.00		11’	11’	11’	11’	n/a	11’	n/a	11’						
	13.33		14’	14’	14’	14’	14’	n/a	14’	n/a	14’					
	14.66		17’	17’	17’	17’	17’	17’	n/a	17’	n/a	17’				
	16.00		20’	20’	20’	20’	20’	20’	20’	n/a	20’	n/a	20’			
	17.33		22'	22'	22'	22'	22'	22'	22'	22'	n/a	22'	n/a	22'		
	18.66		25’	25’	25’	25’	25’	25’	25’	25’	25’	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’



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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.

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