



**REVIEW NOTES**  
**GUILFORD BRO 1442(36) – BRIDGE NO. 65**  
**RETAINING WALL SUBMITTAL**  
**AUGUST 26, 2014**

**RE:** Redi Rock Retaining Wall received from Renaud Bros. Inc on 8/26/2014.

**VHB Project No.:** 57427.00

*These notes accompany the review of the Redi Rock Retaining Wall Submittal reviewed by VHB on 8/26/2014.*

<b>SUBMITTAL REVIEW</b>	
<input checked="" type="checkbox"/>	Reviewed and approved but only for conformance to the Construction Contract Documents.
<input type="checkbox"/>	Revise and Resubmit
<p>Corrections or comments made during this review do not relieve the Contractor or his Designer from compliance with professional requirements or for responsibility for the adequacy of the submittal information. This check is only for review of general conformance with industry standards and general compliance with the information given in the Contract Documents. VHB has not conducted a detailed review of the submittal and has not performed calculations or assessed the adequacy of loads, design criteria, quantities, dimensions, etc. Approval of the submittal does not constitute VHB's approval of any construction means, methods or techniques. These remain the responsibility of the Contractor.</p>	
	<p><b>Yvanasse Hangen Brustlin, Inc.</b> 7056 US Route 7 • Post Office Box 120 North Ferrisburgh, VT 05473 802.425.7788</p>
	<p>Job Number: 57427.00 Reviewed By: E.A. Fiala Date: August 26, 2014</p>

This submittal is for sheets 1-11, inclusive, of the “Guilford BRO 1442 (36) – Retaining Wall 003.pdf” submittal received on 8/26/2014.

# RENAUD BROS., INC.

283 Fort Bridgeman Road #2, Vernon, VT 05354

phone (802) 257-7383  
fax (802) 257-7308

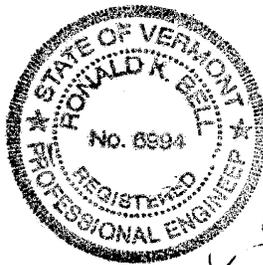
## Guilford BRO 1442 (36) Retaining Wall Submittal

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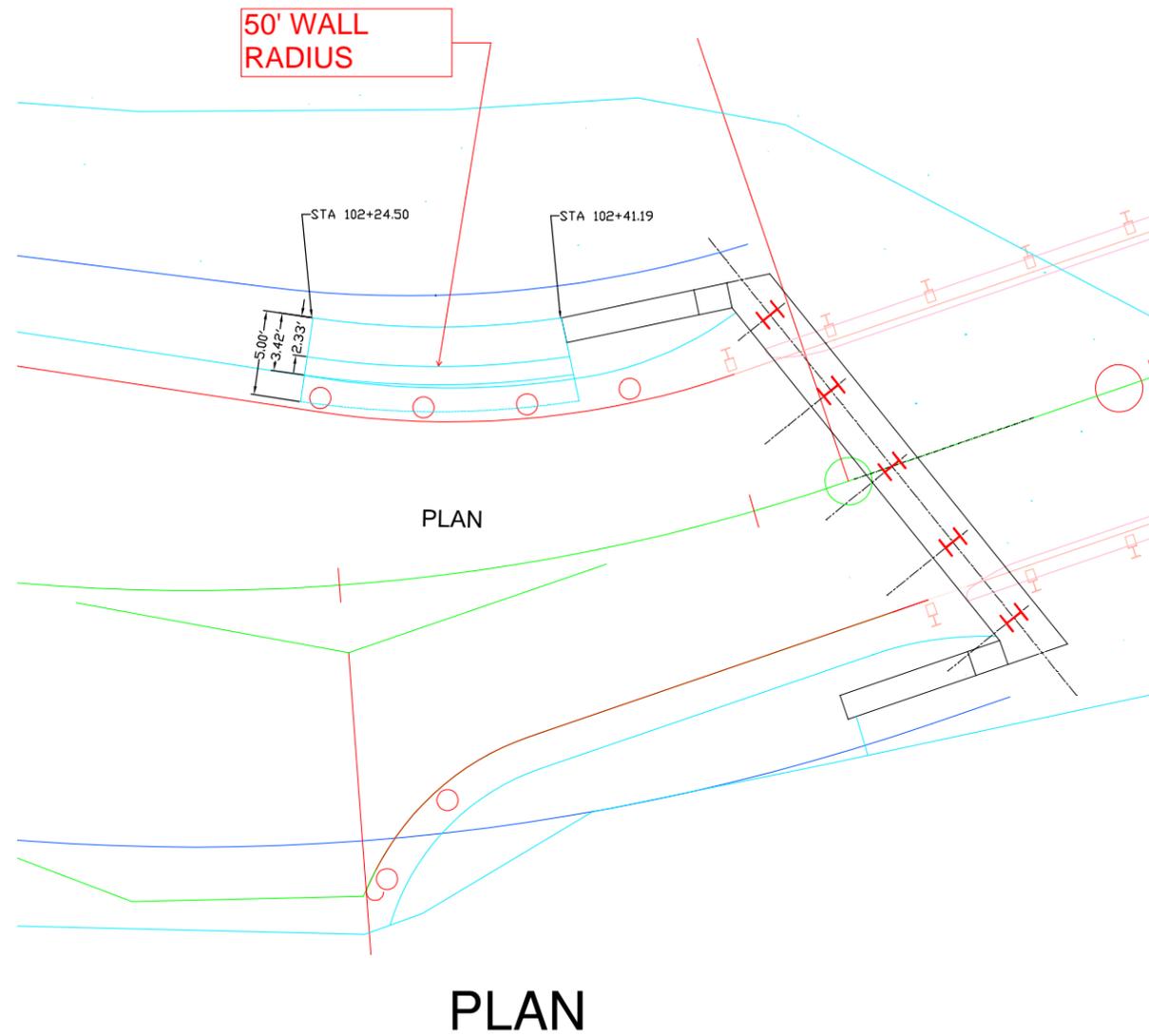
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Retaining Wall Calculations  
Retaining Wall Block Details

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*Ronald K. Bell*



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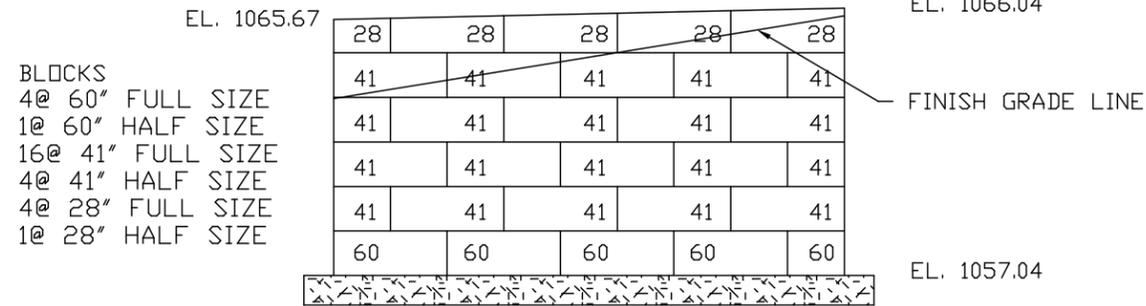
Retaining Wall 003.pdf

CK'D BY MJC OK'D BY TAS

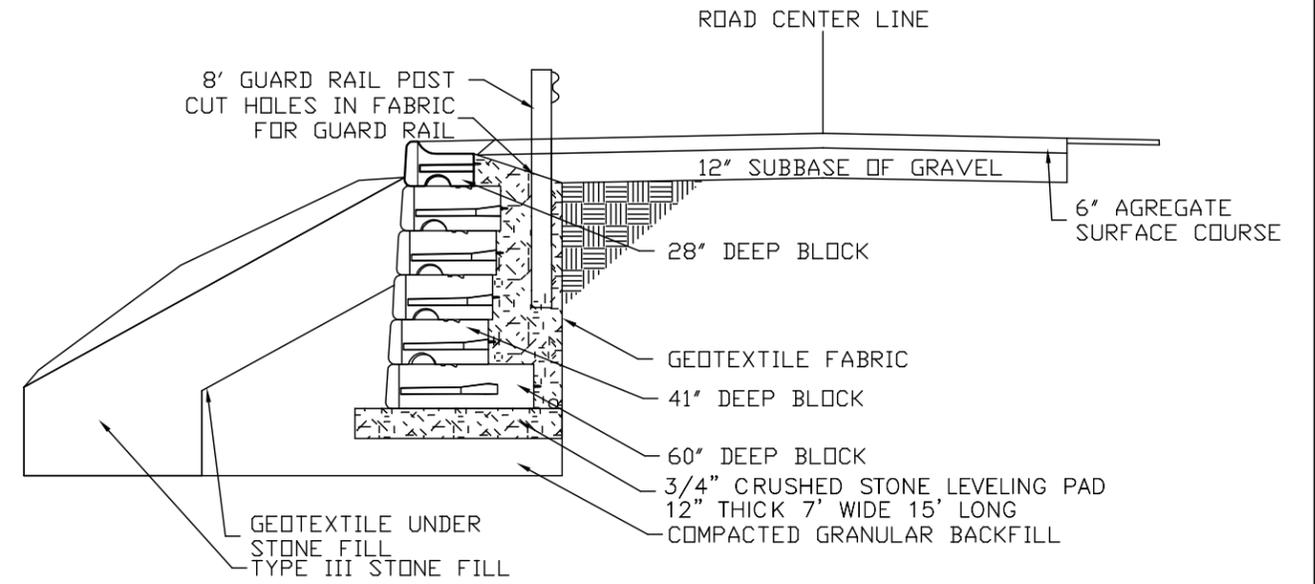
August 25, 2014

RESUBMIT No Approved                       
 BY M. J. Chenette DATE 08/27/2014

REV. NO.		DATE:		SHEET NAME:		RETAINING WALL PLAN	
1	?	1	??/??	PROJECT NAME:		GUILFORD BRO	
				PROJECT NO:		1442 (36)	
				DRAWN BY:		CHK'D BY:	DATE:
				CDE			07/21/2014
 RENAUD BROS. INC. <small>285 FT. BRIDGMAN RD. VERNON VT., 05554          PH. (802) 251-7585 FAX (802) 251-7508</small>				SHEET NO.		1 OF 8	



ELEVATION



SECTION  
STA 102+31

NOTES:

1. ALL BLOCKS ARE REDI ROCK LIME STONE FINISHED BLOCKS.

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Retaining Wall 003.pdf

CK'D BY MJC OK'D BY TAS

August 25, 2014

RESUBMIT No Approved

BY M. J. Chenette DATE 08/27/2014

REV. NO.		DATE:		SHEET NAME:	
1	?	1	??/??	RETAINING WALL ELEVATION AND SECTION	
RENAUD BROS. INC.				PROJECT NAME:	
285 FT. BRIDGEMAN RD. VERNON VT., 05554				GUILFORD BRO	
PH. (802) 251-7585 FAX (802) 251-7508				PROJECT NO:	
				1442 (36)	
DRAWN BY:		CHK'D BY:		DATE:	
CDE				07/21/2014	
				SHEET NO.	
				2	
				OF	
				8	

## Analysis of Redi Rock wall

### Input data

#### Project

Task : GUILFORD VERMONT  
 Descript. : RETAINING WALL  
 Author : RON BELL  
 Customer : RENAUD BROTHERS CONSTRUCUTION  
 Date : 8/19/2014

#### Settings

(input for current task)

#### Wall analysis

Active earth pressure calculation : Coulomb  
 Passive earth pressure calculation : Caquot-Kerisel  
 Earthquake analysis : Mononobe-Okabe  
 Shape of earth wedge : Calculate as skew  
 Reduction coeff. of contact first block - base : 0.70  
 Verification methodology : according to LRFD

Partial factors on loads (L)			
Permanent design situation			
		Favourable	Unfavourable
Dead load of structural components :	DC =	0.90 [-]	1.25 [-]
Dead load of wearing surfaces :	DW =	0.65 [-]	1.35 [-]
Earth pressure load :	EH =	0.90 [-]	1.50 [-]
Earth surcharge load (permanent) :	ES =	0.75 [-]	1.50 [-]
Vertical pressure of earth fill :	EV =	1.00 [-]	1.35 [-]
Live load surcharge :	LS =	0.00 [-]	1.75 [-]
Water load :	WA =	1.00 [-]	1.00 [-]

Partial factors for resistances (R)			
Permanent design situation			
Partial factor on overturning :	$\gamma_{Re} =$	0.90 [-]	
Partial factor on sliding resistance :	$\gamma_{Rh} =$	0.80 [-]	
Partial factor on bearing capacity :	$\gamma_{Rv} =$	0.45 [-]	
Partial factor on passive resistance :	$\gamma_{Rp} =$	0.50 [-]	

#### Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight $\gamma$ [pcf]
1	Block 28	18.00	27.75	130.00
2	Block 41	18.00	40.50	130.00
3	Block 60	18.00	60.00	130.00
4	Top block 24	18.00	24.00	130.00
5	Planter 41	18.00	40.50	112.00

No.	Description	Shear cap. F [lbf/ft]	Max. shear cap. $F_{max}$ [lbf/ft]	Friction f [°]	Cohesion c [psf]
1	Block 28	1700.00	9000.00	75.00	0.0
2	Block 41	1700.00	9000.00	75.00	0.0

No.	Description	Shear cap. F [lbf/ft]	Max. shear cap. F <sub>max</sub> [lbf/ft]	Friction f [°]	Cohesion c [psf]
3	Block 60	1700.00	9000.00	75.00	0.0
4	Top block 24	1700.00	9000.00	75.00	0.0
5	Planter 41	1700.00	9000.00	75.00	0.0

**Setbacks**

No.	Setback s [in]
1	0.375
2	1.625
3	9.375
4	16.625

**Geometry**

No. group	Description	Count	Setback s [in]
1	Block 60	1	1.62
2	Block 41	4	1.62
3	Block 28	1	1.62

**Base**

**Geometry**

Upper setback  $a_1 = 0.50$  ft  
 Lower setback  $a_2 = 0.50$  ft  
 Height  $h = 1.00$  ft  
 Width  $b = 6.00$  ft

**Material**

Soil creating foundation - CRUSHED STONE  
 Soil bearing capacity  $R_d = 6000.0$  psf

**Basic soil parameters**

Number	Name	Pattern	$\phi_{ef}$ [°]	$C_{ef}$ [psf]	$\gamma$ [pcf]	$\gamma_{su}$ [pcf]	$\delta$ [°]
1	Well graded gravel (GW), dense		41.50	0.0	133.00	70.50	32.00
2	Poorly graded gravel (GP), dense		38.50	0.0	127.00	70.50	32.00
3	CRUSHED STONE		40.00	0.0	130.00	77.50	26.00

All soils are considered as cohesionless for at rest pressure analysis.

**Soil parameters**

**Well graded gravel (GW), dense**

Unit weight :  $\gamma = 133.0$  pcf  
 Stress-state : effective  
 Angle of internal friction :  $\phi_{ef} = 41.50^\circ$   
 Cohesion of soil :  $C_{ef} = 0.0$  psf  
 Angle of friction struc.-soil :  $\delta = 32.00^\circ$

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Saturated unit weight :  $\gamma_{sat} = 133.0$  pcf

**Poorly graded gravel (GP), dense**

Unit weight :  $\gamma = 127.0$  pcf  
 Stress-state : effective  
 Angle of internal friction :  $\phi_{ef} = 38.50^\circ$   
 Cohesion of soil :  $c_{ef} = 0.0$  psf  
 Angle of friction struc.-soil :  $\delta = 32.00^\circ$   
 Saturated unit weight :  $\gamma_{sat} = 133.0$  pcf

**CRUSHED STONE**

Unit weight :  $\gamma = 130.0$  pcf  
 Stress-state : effective  
 Angle of internal friction :  $\phi_{ef} = 40.00^\circ$   
 Cohesion of soil :  $c_{ef} = 0.0$  psf  
 Angle of friction struc.-soil :  $\delta = 26.00^\circ$   
 Saturated unit weight :  $\gamma_{sat} = 140.0$  pcf

**Geological profile and assigned soils**

Number	Layer [ft]	Assigned soil	Pattern
1	12.00	Well graded gravel (GW), dense	
2	-	Poorly graded gravel (GP), dense	

**Terrain profile**

Terrain behind construction has the slope 1: 5.00 (slope angle is 11.31 °).

**Water influence**

GWT behind the structure lies at a depth of 8.00 ft  
 Uplift in foot. bottom due to different pressures is not considered.

**Input surface surcharges**

Number	Surcharge		Action	Mag.1 [lb/ft <sup>2</sup> ]	Mag.2 [lb/ft <sup>2</sup> ]	Ord.x x [ft]	Length l [ft]	Depth z [ft]
	new	change						
1	YES		permanent	250.0				on terrain

Number	Name
1	VEHICLE SURCHARGE

**Resistance on front face of the structure**

Resistance on front face of the structure: at rest  
 Soil on front face of the structure - Poorly graded gravel (GP), dense  
 Soil thickness in front of structure  $h = 1.50$  ft  
 Terrain in front of structure is flat.

**Settings of the stage of construction**

Design situation : permanent

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**Verification No. 1****Forces acting on construction**

Name	F <sub>hor</sub> [lbf/ft]	App.Pt. Z [ft]	F <sub>vert</sub> [lbf/ft]	App.Pt. X [ft]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.0	-4.18	4739.8	2.69	0.900	0.900	1.250
FF resistance	-53.9	-0.50	0.1	0.25	0.900	0.900	1.500
Weight - earth wedge	0.0	-1.45	23.6	5.66	1.000	1.000	1.350
Weight - earth wedge	0.0	-3.59	322.5	4.58	1.000	1.000	1.350
Weight - earth wedge	0.0	-9.58	293.5	3.20	1.000	1.000	1.350
Active pressure	1523.9	-3.46	2343.8	5.17	1.500	0.900	1.500
Water pressure	125.0	-0.67	0.0	3.67	1.000	1.000	1.000
Uplift pressure	0.0	-10.00	0.0	1.59	1.000	1.000	1.000
VEHICLE SURCHARGE	554.1	-5.16	849.2	4.81	1.500	0.750	1.500

**Verification of complete wall****Check for overturning stability**Resisting moment  $M_{res} = 34486.7$  lbfft/ftOverturning moment  $M_{ovr} = 12268.1$  lbfft/ft**Wall for overturning is SATISFACTORY****Check for slip**Resisting horizontal force  $H_{res} = 5415.76$  lbf/ftActive horizontal force  $H_{act} = 1863.55$  lbf/ft**Wall for slip is SATISFACTORY****Overall check - WALL is SATISFACTORY**

Maximum stress in footing bottom :2133.3psf

**Bearing capacity of foundation soil****Forces acting at the centre of the footing bottom**

Number	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [ft]	Stress [psf]
1	3316.3	11577.76	3161.11	0.31	1804.0
2	1927.0	7651.76	1863.55	0.29	2133.3

**Bearing capacity of foundation soil check****Eccentricity verification**Max. eccentricity of normal force  $e = 3.76$  inMaximum allowable eccentricity  $e_{alw} = 23.76$  in**Eccentricity of the normal force is SATISFACTORY****Footing bottom bearing capacity verification**Design bearing capacity of foundation soil  $R = 5000.0$  psfPartial factor on earth resistance  $\gamma_{Rv} = 0.45$ Max. stress at footing bottom  $\sigma = 2133.3$  psfBearing capacity of foundation soil  $R_d = 2250.0$  psf

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**Bearing capacity of foundation soil is SATISFACTORY**

**Overall verification - bearing capacity of found. soil is SATISFACTORY**

## Dimensioning No. 1

### Forces acting on construction

Name	F <sub>hor</sub> [lbf/ft]	App.Pt. Z [ft]	F <sub>vert</sub> [lbf/ft]	App.Pt. X [ft]	Coeff. overtur.	Coeff. sliding	Coeff. stress
Weight - wall	0.0	-3.91	3959.8	2.13	0.900	0.900	1.250
FF resistance	-6.0	-0.17	0.0	0.00	0.900	0.900	0.900
Weight - earth wedge	0.0	-2.59	322.5	4.08	1.000	1.000	1.350
Weight - earth wedge	0.0	-8.58	293.5	2.70	1.000	1.000	1.350
Active pressure	1214.6	-3.14	1684.6	4.40	1.500	1.500	1.500
Water pressure	31.2	-0.33	0.0	3.17	1.000	1.000	1.000
Uplift pressure	0.0	-9.00	0.0	1.09	1.000	1.000	1.000
VEHICLE SURCHARGE	489.7	-4.73	707.0	4.10	1.500	1.500	1.500

### Verification of block No.1

#### Check for overturning stability

Resisting moment  $M_{res} = 22627.4$  lbfft/ft

Overturning moment  $M_{ovr} = 9201.4$  lbfft/ft

**Joint for overturning stability is SATISFACTORY**

#### Check for slip

Resisting horizontal force  $H_{res} = 4562.23$  lbf/ft

Active horizontal force  $H_{act} = 2582.28$  lbf/ft

**Joint for verification is SATISFACTORY**

#### Verification of bearing capacity of soil:

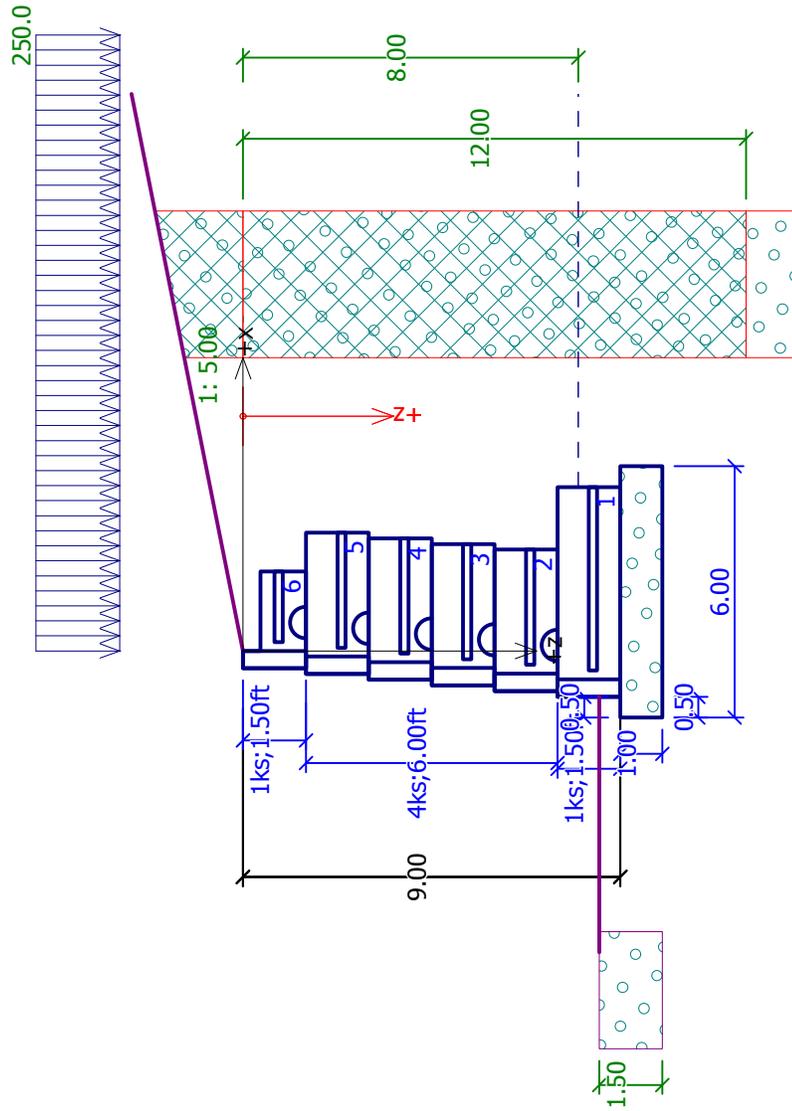
Maximum stress  $\sigma = 2236.4$  psf

Bearing capacity of footing material  $R_d = 2700.0$  psf

**Footing bearing capacity is SATISFACTORY**

Name : Settings

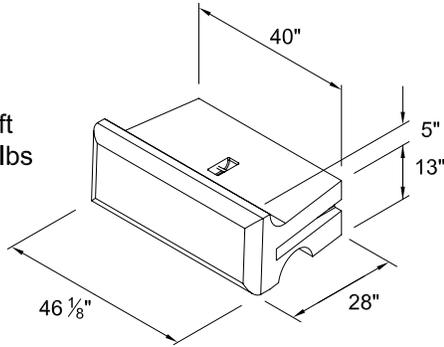
Stage : 1



# 41" SERIES BLOCKS

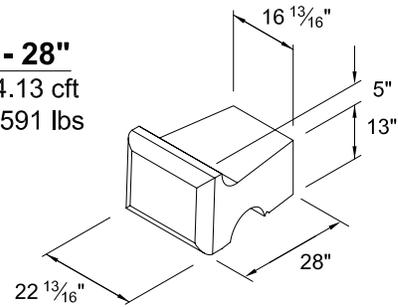
## Top - 28"

Volume = 8.55 cft  
 Weight = ±1223 lbs  
 C of G = 15.06"



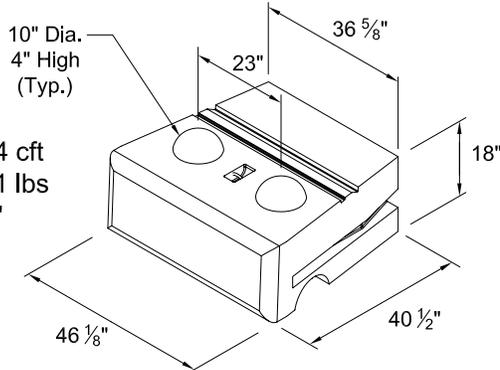
## Half Top - 28"

Volume = 4.13 cft  
 Weight = ±591 lbs



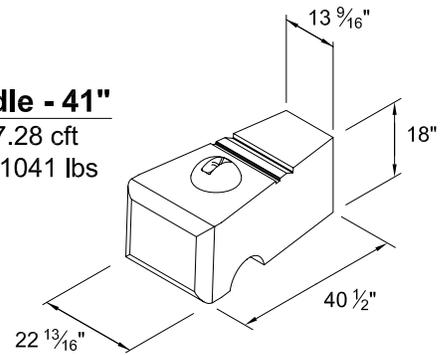
## Middle - 41"

Volume = 16.44 cft  
 Weight = ±2351 lbs  
 C of G = 20.92"



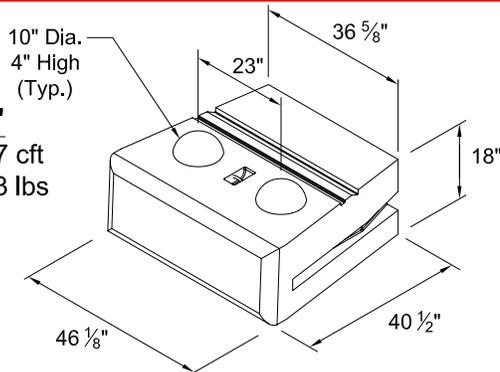
## Half Middle - 41"

Volume = 7.28 cft  
 Weight = ±1041 lbs



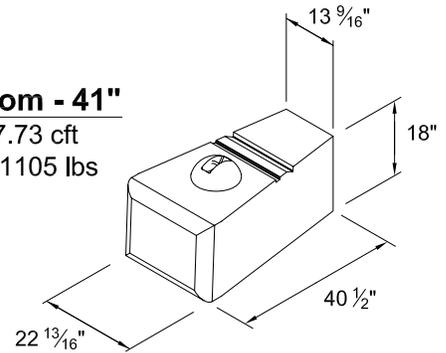
## Bottom - 41"

Volume = 17.37 cft  
 Weight = ±2483 lbs  
 C of G = 21.3"



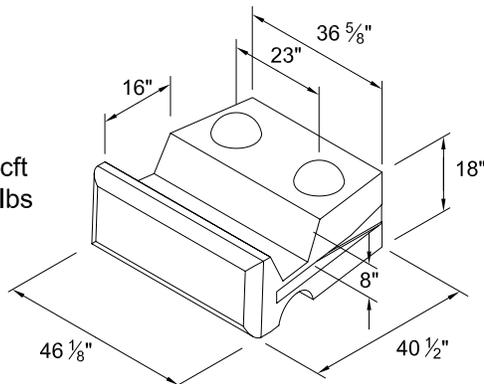
## Half Bottom - 41"

Volume = 7.73 cft  
 Weight = ±1105 lbs



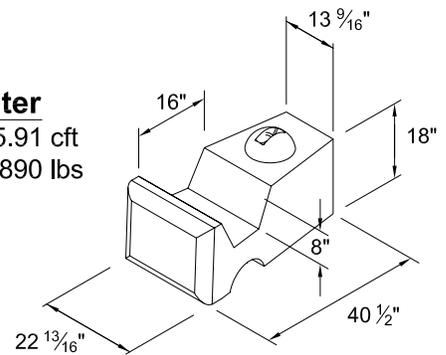
## Planter

Volume = 14.12 cft  
 Weight = ±2020 lbs  
 C of G = 19.35"



## Half Planter

Volume = 5.91 cft  
 Weight = ±890 lbs



### NOTES:

Volume and Center of Gravity (C of G) calculations are based on the blocks as shown.

Center of Gravity is measured from the back of the block.

Half blocks may include a fork lift slot on one side.

Actual weights and volumes may vary.

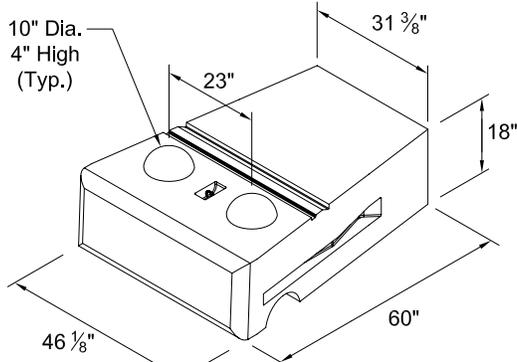
Weight shown is based on 143 pcf concrete.

DRAWN BY J. JOHNSON	01/09/09	Redi-Rock® International, LLC	
CHECKED BY			
APPROVED BY		DRAWING FILE 41in Series Blocks 010909.dwg	REVISION ---
ISSUE DATE		SCALE NO SCALE	SHEET NO. 1 OF 1

# 60" BLOCKS

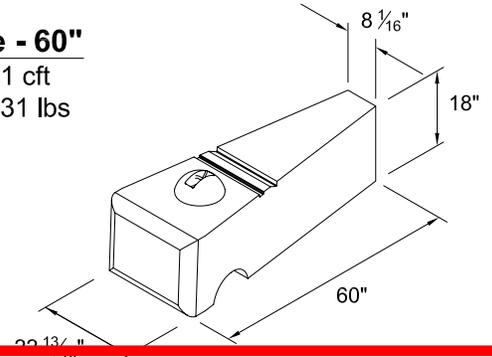
## Middle - 60"

Volume = 23.0 cft  
 Weight = ±3290 lbs  
 C of G = 31.28"



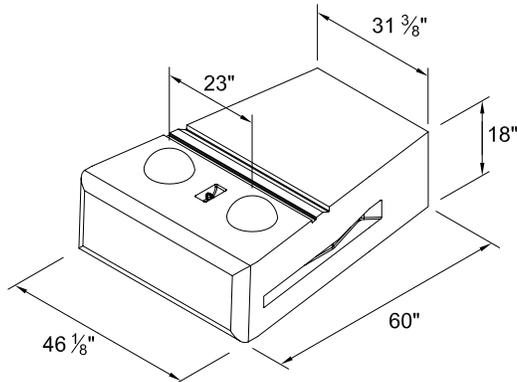
## Half Middle - 60"

Volume = 9.31 cft  
 Weight = ±1331 lbs



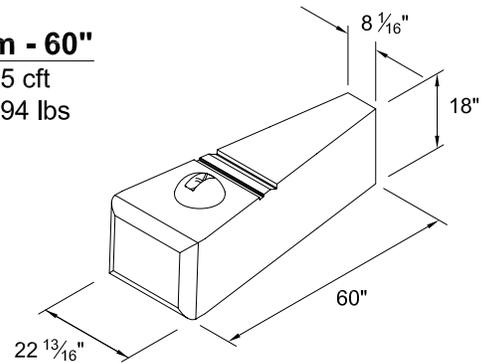
## Bottom - 60"

Volume = 23.9 cft  
 Weight = ±3420 lbs  
 C of G = 31.90"



## Half Bottom - 60"

Volume = 9.75 cft  
 Weight = ±1394 lbs



### NOTES:

The 60" block is typically used as a bottom block in a larger wall. See the 41" Series for additional blocks and steps.

Volume and Center of Gravity (C of G) calculations are based on the blocks as shown.

Center of Gravity is measured from the back of the block.

Half blocks may include a fork lift slot on one side.

Actual weights and volumes may vary.

Weight shown is based on 143 pcf concrete.

DRAWN BY J. JOHNSON	01/12/09	Redi-Rock® International, LLC	
CHECKED BY			
APPROVED BY		DRAWING FILE 60in Block Details 011209.dwg	REVISION ---
ISSUE DATE		SCALE NO SCALE	SHEET NO. 1 OF 1