VAN DEURZEN AND ASSOCIATES, P.A.
CONSULTING STRUCTURAL ENGINEERS
11011 KING STREET, SUITE 130
COMMERCE TERRACE BUILDING D
OVERLAND PARK, KANSAS 66210
(913) 451 - 6305 FAX (913) 451 - 1021

November 19, 2020

Mr. Brett Shelton
IQ Home Builders
P.O. Box 6423
Lee's Summit, MO 64064

RE: Retaining Wall Inspection & Evaluation
2417 SW River Trail Road
Lee's Summit, MO
Bldg. Permit No.: PRRES 2020-0759

Dear Mr. Shelton:

Per your request, Van Deurzen and Associates, P.A. performed an inspection of the retaining wall on the above referenced site on October 29 2020. The purpose of the inspection was to observe the construction of the retaining and to identify any problems. The services rendered are in accordance with the standard of care exercised by other professional structural engineers in this community under the same or similar circumstances.

The retaining wall inspected is located on the along the northwest corner of the house and runs north. The wall provides the grade separation between the lower side yard and the higher front yard. The retaining walls consist of limestone ledge rock retaining wall units measuring 14" tall, 24" wide with a maximum exposed height of 4'-8" with clean gravel backfill.

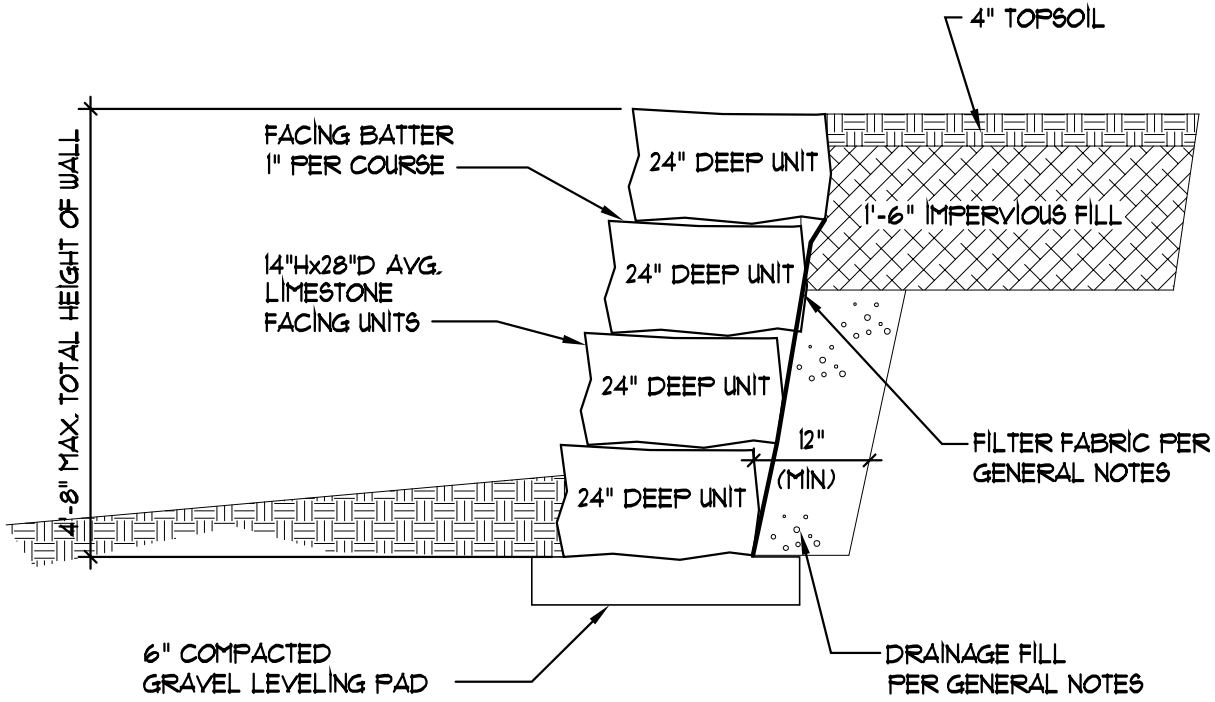
Our inspection consisted of viewing finished retaining wall and the grades around the retaining wall. At the time of our inspection on October 29, the retaining wall had been completed. Our inspection revealed no indication of settlement or distress of the retaining wall or surrounding grades and the wall had been constructed with the proper set back between courses. Based on our inspection, we believe the wall has been constructed in accordance with the enclosed retaining wall detail and calculations provided by this office, the applicable provisions of the building code and good construction practices. Based on our inspection, we believe that the wall is performing and no corrective actions are required to the retaining wall.

We trust this report meets with your needs, if you need any additional information please do not hesitate to contact this office.

Sincerely,
VAN DEURZEN AND ASSOCIATES, P.A.

11/19/2020

Reviewed by
Michael Jones Chad M Streeter P.E.



GRAVITY RETAINING WALL SECTION

SCALE: ½" = 1'-0"

STATE OF MISSOURI
CHAD M. STREETER
NUMBER PE-2005010817
PROFESSIONAL ENGINEER
11/19/2020

DATE: 11/19/2020
BY: MEJ
JOB:
SHEET NO. SK1

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STACKED STONE RETAINING WALL
2417 SW RIVER TRAIL RD
LEE'S SUMMIT, MISSOURI

2417 SW River Trail Road

Lee's Summit, Mo

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Reinforced Soil Retaining Wall Design

VAN DEURZEN AND ASSOCIATES, P.A.

November 19, 2020

Conventional Segmental Retaining Wall Design

Wall Height	Surcharge	backfill inclination	Excess Leveling pad each side	Thickness of leveling pad
$H := 4.67 \cdot ft$	$q := 0 \cdot psf$	$\beta := 0.0 \cdot deg$	$l_p := 6.0 \cdot in$	$t_p := 6.0 \cdot in$

Block Properties:

Unit Height	Unit Width	Unit density	masonry friction	Centroid	Setback
$H_u := 14 \cdot in$	$W_u := 24 \cdot in$	$\gamma_u := 140 \cdot pcf$	$\mu_b := 0.80$	$G_u := 12.0 \cdot in$	$\Delta_u := .5 \cdot in$

Batter

$$\omega := \operatorname{atan}\left(\frac{\Delta_u}{H_u}\right)$$

$\omega = 2.045\,deg$

Soil Properties:

Leveling pad	Retained Soil	Foundation Soil
$\gamma_d := 120 \cdot pcf$	$\gamma_r := 120 \cdot pcf$	$\gamma_f := 120 \cdot pcf$
$\phi_d := 32 \cdot deg$	$\phi_r := 26 \cdot deg$	$\phi_f := 26 \cdot deg$
		$c_f := 0psf$

Internal Interface Friction Angle

$$\delta_e := \frac{2}{3} \cdot \phi_r \qquad \delta_e = 17.333\,deg$$

External Active Earth Pressure

$$K_a := \frac{\cos(\phi_r + \omega)^2}{\cos(\omega)^2 \cdot \cos(\omega - \delta_e) \cdot \left[1 + \sqrt{\left(\frac{\sin(\phi_r + \delta_e) \cdot \sin(\phi_r - \beta)}{\cos(\omega - \delta_e) \cdot \cos(\omega + \beta)}\right)}\right]^2}$$

$K_a = 0.333$

Hinge Height

$$H_h := 2 \cdot \frac{(W_u - G_u)}{\tan(\omega)}$$

$H_h = 56\,ft$

Horizontal Earth Pressure - at leveling pad elevation

self weight

$P_{s1} := \frac{1}{2}\cdot K_a\cdot\gamma_r\cdot H^2\cdot\cos(\delta_e - \omega)$ $P_{s1} = 420\ plf$

distance from toe

$Y_{s1} := \left(\frac{H}{3}\right)$ $Y_{s1} = 1.557\ ft$

surcharge

$P_{q1} := q\cdot K_a\cdot H\cdot\cos(\delta_e - \omega)$ $P_{q1} = 0\ plf$

distance from toe

$Y_{q1} := \left(\frac{H}{2}\right)$ $Y_{q1} = 2.335\ ft$

Resultants

$P_{a1} := P_{s1} + P_{q1}$ $P_{a1} = 420\ plf$

Horizontal Earth Pressure - at bottom of leveling pad

self weight

$P_{s2} := \frac{1}{2}\cdot K_a\cdot\gamma_r\cdot(H + t_p)^2\cdot\cos(\delta_e - \omega)$ $P_{s2} = 515\ plf$

distance from toe

$Y_{s2} := \left(\frac{H + t_p}{3}\right)$ $Y_{s2} = 1.723\ ft$

surcharge

$P_{q2} := q\cdot K_a\cdot(H + t_p)\cdot\cos(\delta_e - \omega)$ $P_{q2} = 0\ plf$

distance from toe

$Y_{q2} := \left(\frac{H + t_p}{2}\right)$ $Y_{q2} = 2.585\ ft$

Resultants

$P_{a2} := P_{s2} + P_{q2}$ $P_{a2} = 515\ plf$

Weight of Segmental Units

$W_w := H\cdot\gamma_u\cdot W_u$ $W_w = 1307.6\ plf$

Resistance from block to leveling pad

$R_{s1} := (W_w\cdot\tan(\phi_d))\cdot\mu_b$ $R_{s1} = 654\ plf$

Resistance from leveling pad to soil

$R_{s2} := \left[W_w + (H + t_p)\cdot\gamma_d\cdot l_p\right]\cdot\tan(\phi_f) + (W_u + l_p)\cdot c_f$ $R_{s2} = 789\ plf$

Sliding

Factor Safety for Sliding at leveling pad elevation = 1.5

$FS_{sl1} := \frac{R_{s1}}{(P_{a1})}$ $\boxed{FS_{sl1} = 1.556}$

Factor Safety for Sliding at bottom of leveling pad = 1.5

$FS_{sl2} := \frac{R_{s2}}{(P_{a2})}$ $\boxed{FS_{sl2} = 1.533}$

Overturning

Overturning Moment about toe of bottom block

$M_o := P_{s1} \cdot Y_{s1} + P_{q1} \cdot Y_{q1}$ $M_o = 654\,\text{lbf}$

resisting moment arm

$X_w := \left[G_u + \frac{1}{2} \cdot \left[\left(H - H_u \right) \cdot \tan(\omega) \right] \right]$ $X_w = 1.063\,\text{ft}$

resisting moment

$M_r := W_w \cdot X_w$ $M_r = 1389.403\,\text{lbf}$

Factor of Safety for Overturing = 2.0

$FS_o := \frac{M_r}{M_o}$ $FS_o = 2.125$

Base Eccentricity

block eccentricity

$e := \frac{W_u}{2} - \frac{M_r - M_o}{W_w}$ $e = 0.438\,\text{ft}$

$e := \text{if}(e < 0, 0, e)$ $e = 0.438\,\text{ft}$

Effective footing width

$B_f := W_u + 2 \cdot l_p - 2 \cdot e$ $B_f = 2.125\,\text{ft}$

Applied Bearing Stress

$Q_a := \frac{W_w}{B_f}$ $Q_a = 615\,\text{psf}$