



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

April 12, 2024

Mr. Kevin Brock
Brock Walls
P.O. Box 860114
Shawnee, Kansas 66286

RE: Retaining Wall Evaluation
1600 SW 27th Street
Lee's Summit, Missouri

Dear Mr. Brock:

Per your request, Van Deurzen and Associates, P.A. inspected the retaining wall on the above referenced site on April 4, 2024. The purpose of the inspection was to observe the construction/finished condition of the retaining wall 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 northwest corner of the house. The retaining wall provide the grade separation between the lower side yard and higher back yard. The retaining wall consist of natural limestone rock units measuring 18" tall, 24" wide with a maximum exposed height of 4'-6" with clean gravel backfill.

Our inspection consisted of viewing the finished retaining wall and the grades around the retaining wall. At the time of our inspection on April 4, 2024, the retaining wall has been completed. Our inspection revealed no indication of settlement or distress of the retaining wall or surrounding grades and the wall has been constructed with the proper set back between courses. Based on our inspection, we believe the wall have 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.

Mr Kevin Brock
RE: **1600 SW 27th Street**

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April 12, 2024

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.

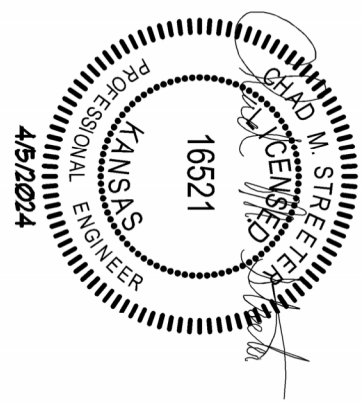
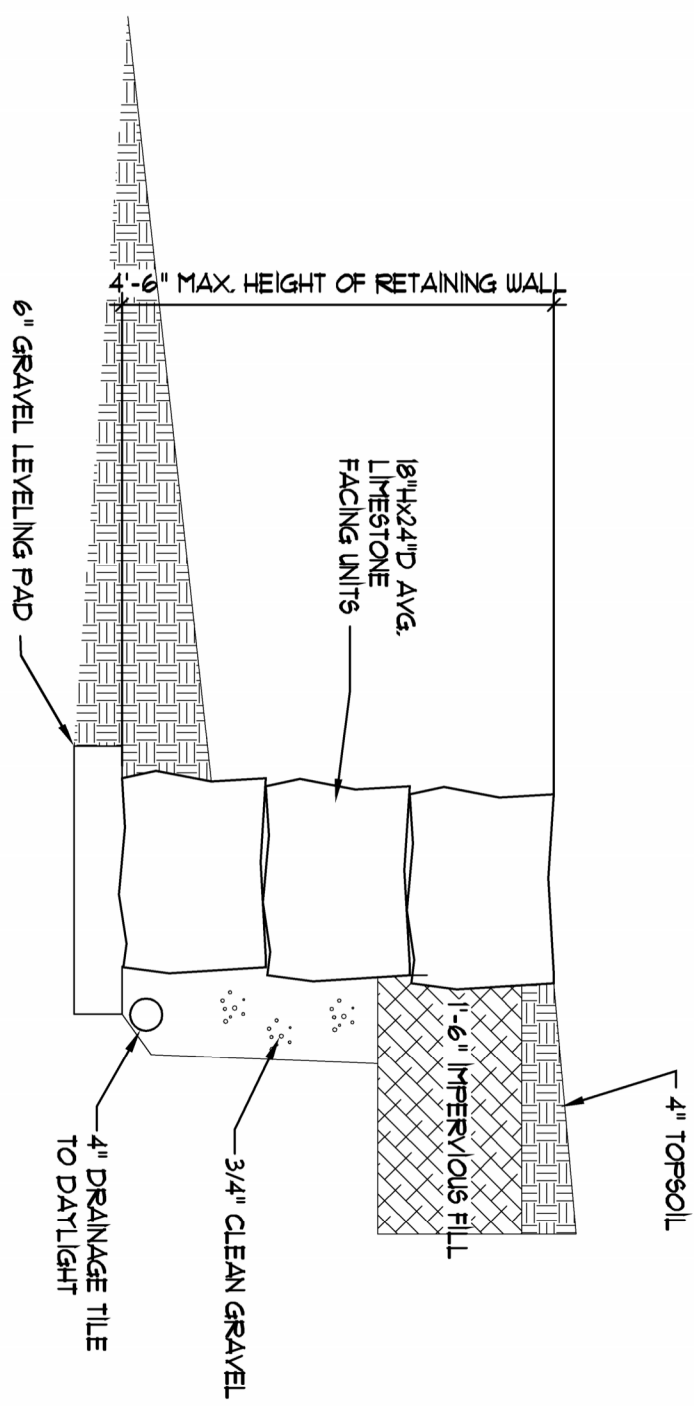


4/12/2024

Michael Jones

Reviewed by
Chad M Streeter P.E.

REINFORCED SOIL RETAINING WALL SECTION SCALE: 1/2" = 1'-0"



STONE RETAINING WALL
1600 SW 27TH STREET

LEE'S SUMMIT, MISSOURI

V/A VAN DEURZEN & ASSOCIATES, P.A.
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DATE: 4/5/2024
BY: MEJ
JOB:
SHEET NO.
SK1

21808 State Line Road
Bucyrus, Kansas

VAN DEURZEN AND ASSOCIATES, P.A.

CONSULTING STRUCTURAL ENGINEERS

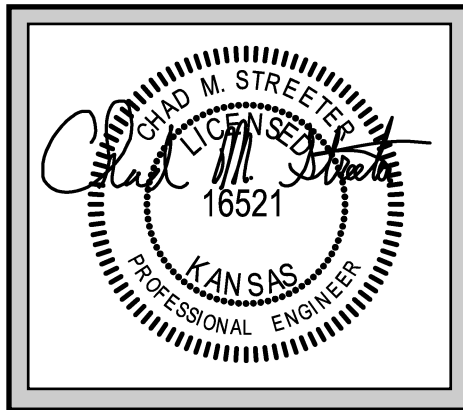
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Reinforced Soil Retaining Wall Design



VAN DEURZEN AND ASSOCIATES, P.A.

February 16, 2024

Conventional Segmental Retaining Wall Design

Wal Height	Surcharge	backfill inclination	Excess Leveling pad each side	Thickness of leveling pad
$H_w := 4.50 \cdot \text{ft}$	$q := 0 \cdot \text{psf}$	$\beta := 4.0 \cdot \text{deg}$	$l_p := 6 \cdot \text{in}$	$t_p := 6.0 \cdot \text{in}$

Block Properties:

Unit Height	Unit Width	Unit density	masonry friction	Centroid	Setback	Batter
$H_u := 18 \cdot \text{in}$	$W_u := 24 \cdot \text{in}$	$\gamma_u := 140 \cdot \text{pcf}$	$\mu_b := 0.80$	$G_u := 12.0 \cdot \text{in}$	$\Delta_u := 1.0 \cdot \text{in}$	$\omega := \text{atan}\left(\frac{\Delta_u}{H_u}\right)$ $\omega = 3.18 \text{ deg}$

Soil Properties:

Leveling pad	Retained Soil	Foundation Soil
$\gamma_d := 110 \cdot \text{pcf}$	$\gamma_r := 120 \cdot \text{pcf}$	$\gamma_f := 120 \cdot \text{pcf}$
$\phi_d := 32 \cdot \text{deg}$	$\phi_r := 26 \cdot \text{deg}$	$\phi_f := 26 \cdot \text{deg}$
		$c_f := 0 \cdot \text{psf}$

Internal Interface Friction Angle

$$\delta_e := \frac{2}{3} \cdot \phi_r \quad \delta_e = 17.333 \text{ deg}$$

External Active Earth Pressure

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

$$K_a = 0.343$$

Hinge Height

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

$$H_h = 36 \text{ ft}$$

Horizontal Earth Pressure - at leveling pad elevation

self weight

$$P_{s1} := \frac{1}{2} \cdot K_a \cdot \gamma_r \cdot H^2 \cdot \cos(\delta_c - \omega) \quad P_{s1} = 404 \text{ plf}$$

distance from toe

$$Y_{s1} := \left(\frac{H}{3} \right) \quad Y_{s1} = 1.5 \text{ ft}$$

Resultants

$$P_{a1} := P_{s1} + P_{q1} \quad P_{a1} = 404 \text{ plf}$$

surcharge

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

distance from toe

$$Y_{q1} := \left(\frac{H}{2} \right) \quad Y_{q1} = 2.25 \text{ ft}$$

Horizontal Earth Pressure - at bottom of leveling pad

self weight

$$P_{s2} := \frac{1}{2} \cdot K_a \cdot \gamma_r \cdot (H + t_p)^2 \cdot \cos(\delta_c - \omega) \quad P_{s2} = 498 \text{ plf}$$

distance from toe

$$Y_{s2} := \left(\frac{H + t_p}{3} \right) \quad Y_{s2} = 1.667 \text{ ft}$$

Resultants

$$P_{a2} := P_{s2} + P_{q2}$$

surcharge

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

distance from toe

$$Y_{q2} := \left(\frac{H + t_p}{2} \right) \quad Y_{q2} = 2.5 \text{ ft}$$

$$P_{a2} = 498 \text{ plf}$$

Weight of Segmental Units

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

$$W_w = 1260 \text{ plf}$$

Resistance from block to leveling pad

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

$$R_{s1} = 630 \text{ plf}$$

Resistance from leveling pad to soil

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

$$R_{s2} = 749 \text{ plf}$$

Sliding

Factor Safety for Sliding at leveling pad elevation = 1.5

$$FS_{s11} := \frac{R_{s1}}{(P_{a1})}$$

$$FS_{s11} = 1.56$$

Factor Safety for Sliding at bottom of leveling pad = 1.5

$$FS_{s12} := \frac{R_{s2}}{(P_{a2})}$$

$$FS_{s12} = 1.502$$

Overtuning

Overtuning Moment about toe of bottom block

$$M_o := P_{sl} \cdot Y_{sl} + P_{ql} \cdot Y_{ql}$$

$$M_o = 606 \text{ lbf}$$

resisting moment arm

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

$$X_w = 1.083 \text{ ft}$$

resisting moment

$$M_r := W_w \cdot X_w$$

$$M_r = 1365 \text{ lbf}$$

Factor of Safety for Overtuning = 2.0

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

$$FS_o = 2.254$$

Base Eccentricity

block eccentricity

$$e := \frac{W_u}{2} - \frac{M_r - M_o}{W_w}$$

$$e = 0.397 \text{ ft}$$

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

$$e = 0.397 \text{ ft}$$

Effective footing width

$$B_f := W_u + 2 \cdot l_p - 2 \cdot e$$

$$B_f = 2.205 \text{ ft}$$

Applied Bearing Stress

$$Q_a := \frac{W_w}{B_f}$$

$$Q_a = 571 \text{ psf}$$