EXHIBIT B - ENGINEERED WALL PLAN

SEC
Symons Engineering Consultants, Inc.

12805 S.E. Foster Road
Portland, OR 97236
(503) 760-1353
Fax 762-1962

**MEMO**

| | | | |
|---|---|---|---|
| **TO:** | Ron Bistline | **DATE:** | September 19, 2018 |
| **FIRM:** | 716 4th Street<br>Oregon City, OR | | |
| **FROM:** | Dan Symons | | |
| **PROJECT:** | 2' Gravity Wall in ROW | **PROJECT No:** | 15-08 |

At your request I have reviewed a 2' high rockery wall proposed in 4th Street in front of the above address. If the wall is constructed in accordance with and, at a minimum, to meet or exceed the attached requirements then the installation shall be considered in general conformance with industry standards.

REGISTERED PROFESSIONAL ENGINEER 16091 OREGON JULY 21, 1982 DAN E. SYMONS

RENEWS 6/30/20

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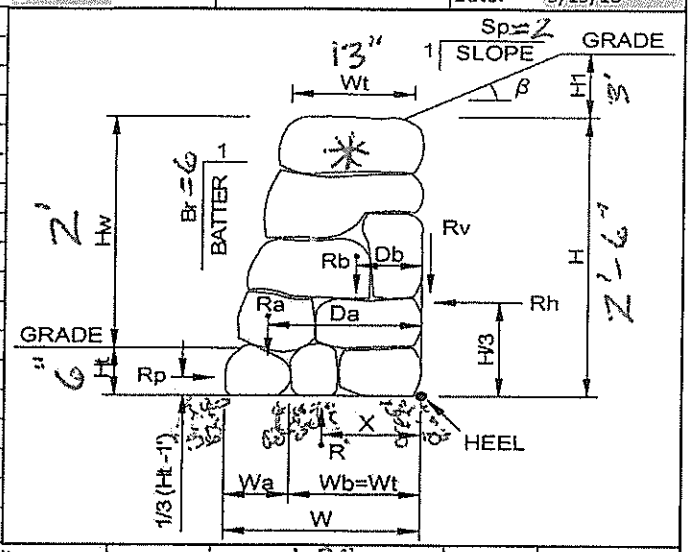
| Symons Engineering Consultants, Inc. | | | | GRAVITY | | Project: Bistline |
|---|---|---|---|---|---|---|
| 12805 SE Foster Rd | | | | ~~Gavity~~ Boulder | | Project #: 15-08 |
| Portland, OR 97236 | | | | GW= 2 FT | | Date: 9/19/18 |
| 503-760-1353, fax: 762-1962 | | | | | | |




| Retaining Wall Properties: | | | |
|---|---|---|---|
| W= | 1.5 | ft | Wall Base Width |
| Hw | 2 | ft | Wall Ht |
| H1= | 3 | ft | Grade Slope Soil Ht |
| Ht= | 0.5 | ft | Toe Depth Below Grade |
| Pb= | 1500 | psf | Allowable Soil Bearing |
| Pp= | 300 | Psf/ft | Passive Soil Pressure |
| f= | 0.6 | | Soil Friction Coeff |
| Ws= | 120 | pcf | Soil Unit Wt |
| Wr= | 145 | pcf | Rock Unit Wt |
| Br= | 6 | | Wall Batter of Face |
| Sp= | 2 | | Grade Slope |

| Active Soil Pressure from Appendix A Chart: | | | | | |
|---|---|---|---|---|---|
| β= | 26.6 | deg | Slope Angle | | |
| H= | 2.5 | ft | Retained Wall Ht | H = Hw + Ht | |
| H1/H= | 1.20 | | Ht Ratio | | |
| Kh= | 60 | psf/ft | Horizontal Active Soil Pressure | | |
| Kv= | 27 | psf/ft | Vertical Active Soil Pressure | | |

| Active Soil Pressure Recation: | | | | |
|---|---|---|---|---|
| Rh= | 0.19 | kips | Horizontal Force | Rh = (1/2)*Kh*H^2 |
| Rv= | 0.08 | kips | Vertical Force | Rv = (1/2)*Kv*H^2 |

| Overturning Moment about Heel of Wall: | | | | |
|---|---|---|---|---|
| H/3= | 0.83 | ft | Moment Arm | |
| OM= | 0.16 | k-ft | Overturning Moment | OM = Rh*(H/3) |

| Vertical Reaction Force From Boulder Rock Wt: | | | | |
|---|---|---|---|---|
| Wt= | 1.08 | ft | Top width of Wall | Wt = Wb |
| Wa= | 0.42 | ft | Wall Batter Base Width | Wa = H/Br |
| Wb= | 1.08 | ft | Wall Base Width | Wb = W - Wa |
| Ra= | 0.08 | kips | Batter Vertical Reaction | Ra = (1/2)*Wa*H*Wr |
| Rb= | 0.39 | kips | Base Vertical Reaction | Rb = Wb*H*Wr |
| R= | 0.47 | kips | Vertical Resultant | R = Ra + Rb |

| Resistive Moment about Heel of Wall: | | | | |
|---|---|---|---|---|
| Da= | 1.22 | ft | Moment Arm | Da = (1/3)*Wa + Wb |
| Db= | 0.54 | ft | Moment Arm | Db = (1/2)*Wb |
| X= | 0.99 | OK | | X = (OM + Ra*Da + Rb*Db)/R |
| RM= | 0.46 | k-ft | Resistive Moment | RM = R*X |

| Overturning Factor of Safety: | | | | |
|---|---|---|---|---|
| OM F.S.= | 2.95 | OK | Overturning Factor of Safety | OM F.S. = RM/OM ≥ 1.5 |

| Sliding Factor of Safety: | | | | |
|---|---|---|---|---|
| Rp= | 0.00 | kips | Passive Soil Pressure at Toe | Rp = (1/2)*Pp*(Ht-1)^2 |
| P= | 0.47 | kips | Vertical Wall Wt | P = Ra + Rb + Rv |
| f*P= | 0.28 | kips | Sliding friction | |
| Rh= | 0.19 | kips | Horizontal Force | Rh = (1/2)*Kh*H^2 |
| Sliding F. S.= | 1.50 | ~~N.G.~~ O.K. | Sliding Factor of Safety | Sliding F.S. = (f*P + Rp)/Rh ≥ 1.5 |

| Soil Bearing Pressure: | | | | |
|---|---|---|---|---|
| P= | 0.47 | kips | Vertical Wall Wt | P = Ra + Rb |
| A= | 1.50 | sf | Base Area per Foot Width | A = W*(1 ft) |
| M= | -0.11 | k-ft | Moment | M = (1/3)*(Ht-1)*Rp + (1/2)*W*Rv - (1/3)H*Rh + Rb(W/2 - Db) - Ra(Da - W/2) |
| c= | 0.75 | ft | Moment Arm | c = (1/2)*W |
| I= | 0.28 | ft^4 | Moment of Inertia | I = (1/12)*W^3 |
| Pt= | 606 | psf | Toe Bearing Pressure | Ph = P/A - M*c/I |
| Pt= | 19 | psf | Heel Bearing Pressure | Pt = P/A + M*c/I |
| Toe Unity= | 0.40 | OK | Toe Bearing Pressure Unity | Toe Unity = Pt/Pb ≤ 1.0 |
| Heel Unity= | 0.01 | OK | Heel Bearing Pressure Unity | Heel Unity = Ph/Pb ≤ 1.0 |

18"

24" x 6"

THICK 3/4(-) CRUSHED ROCK BASE

ANGULAR STONES SHALL BE SELECTIVELY HAND PLACED TO ENSURE FULL INTERLOCK W/ NO INTERNAL SLIPPAGE & MINIMAL VOIDS

15.08

Landscape Retaining Wall

716-4th Ave Oregon City