



# STRUCTURAL CALCULATIONS

Steinborn Residence 8435 SE 47<sup>th</sup> PL, Mercer Island, WA 98040

Ectypos Architecture 4212 W Mercer Way, Mercer Island, WA 98040

September 23, 2022

Supplemental Calculations – Corrections 1 & Architectural Revisions



Printed: 19 SEP 2022, 3:11PM

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 DESCRIPTION: SE Den/Guest Rm (9/S3.2)

## Code Reference

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

#### Criteria

#### Soil Data

| Retained Height         | = | 4.00 ft |
|-------------------------|---|---------|
| Wall height above soil  | = | 0.50 ft |
| Slope Behind Wall       | = | 0.00    |
| Height of Soil over Toe | = | 6.00 in |
| Water height over heel  | = | 0.0 ft  |
|                         |   |         |

### Surcharge Loads

| Surcharge Over Heel<br>Used To Resist Slidin | g & O   | 40.0 psf<br>verturning |  |  |  |  |
|--|---------|------------------------|--|--|--|--|
| Suicharge Over Tue                           | =       | 0.0                    |  |  |  |  |
| Used for Sliding & Ov                        | erturni | ng                     |  |  |  |  |
| Axial Load Applied to Stem                   |         |                        |  |  |  |  |
| Axial Dead Load                              | =       | 120.0 lbs              |  |  |  |  |

|                         | _ |          |
|-------------------------|---|----------|
| Axial Live Load         | = | 40.0 lbs |
| Axial Load Eccentricity | = | 0.0 in   |

| Allow Soil Bearing<br>Equivalent Fluid Pressure | =<br>Meth | 4,000.0 | psf    |
|---|-----------|---------|--------|
| Active Heel Pressure                            | =         | 40.0    | psf/ft |
|   | =         |         |        |
| Passive Pressure                                | =         | 300.0   | psf/ft |
| Soil Density, Heel                              | =         | 130.00  | pcf    |
| Soil Density, Toe                               | =         | 130.00  | pcf    |
| Footing  Soil Friction                          | =         | 0.450   |        |
| Soil height to ignore<br>for passive pressure   | =         | 12.00   | in     |

BYKONEN CARTER QUINN

#### Lateral Load Applied to Stem

| Lateral Load<br>Height to Top<br>Height to Bottom | =<br>=<br>= | 0.0 #/ft<br>0.00 ft<br>0.00 ft |
|---|-------------|--------------------------------|
| Load Type   | =           | Wind (W)<br>(Service Level)    |
| Wind on Exposed Sten<br>(Strength Level)          | n =         | 0.0 psf                        |



#### Adjacent Footing Load

| Adjacent Footing Load                    | = | 0.0 lbs        |
|--|---|----------------|
| Footing Width                            | = | 0.00 ft        |
| Eccentricity                             | = | 0.00 in        |
| Wall to Ftg CL Dist                      | = | 0.00 ft        |
| Footing Type                             |   | Spread Footing |
| Base Above/Below Soil<br>at Back of Wall | = | 0.0 ft         |
| Poisson's Ratio                          | = | 0.300          |

Printed: 19 SEP 2022, 3:11PM

Project File: Foundations.ec6

# Cantilevered Retaining Wall LIC# : KW-06015393, Build:20.22.7.14

#### BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: SE Den/Guest Rm (9/S3.2)

| Design Summary                |             |                  | Stem Construction       | _      | Bottom           |    |    |  |
|-------------------------------|-------------|------------------|-------------------------|--------|------------------|----|----|--|
|                               |             |                  | Decign Height Above Etc |        | Stem OK          |    |    |  |
| Wall Stability Ratios         |             |                  | Wall Matarial Above Fig | π=     | 0.00<br>Conoroto |    |    |  |
| Overturning                   | =           | 1.67 OK          | Design Method           | _      | SD               | SD | SD |  |
| Sliding                       | =           | 1.51 OK          | Thickness               | _      | 8.00             | 50 | 50 |  |
| Global Stability              | _           | 2 31             | Rebar Size              | =      | # 4              |    |    |  |
| Clobal Clability              | -           | 2.01             | Rebar Spacing           | =      | 12.00            |    |    |  |
| Total Bearing Load            | _           | 1 511 lbs        | Rebar Placed at         | =      | Edge             |    |    |  |
| resultant ecc.                | =           | 7.01 in          | Design Data             |        | 0                |    |    |  |
| Eccentricity outsid           | de mido     | dle third        | fb/FB + fa/Fa           | =      | 0.155            |    |    |  |
| Soil Pressure @ Toe           | =           | 2,193 psf OK     | Total Force @ Section   |        |                  |    |    |  |
| Soil Pressure @ Heel          | =           | 0 pst OK         | Service Level           | lbs =  |                  |    |    |  |
| Allowable                     | =<br>Thon ( | 4,000 psf        | Strength Level          | lbs =  | 590.8            |    |    |  |
| ACL Eactored @ Toe            |             | 3 070 pef        | MomentActual            |        |                  |    |    |  |
| ACI Factored @ Heel           | =           | 0 nsf            | Service Level           | ft-# = |                  |    |    |  |
| Footing Shear @ Toe           | _           | 0.8 psi OK       | Strength Level          | ft-# = | 840.2            |    |    |  |
| Footing Shear @ Heel          | _           | 6.4 psi OK       | MomentAllowable         | =      | 5,412.6          |    |    |  |
|                               | _           | 75.0 nsi         | ShearActual             |        |                  |    |    |  |
| Allowable                     | -           | 70.0 p3i         | Service Level           | psi =  |                  |    |    |  |
| Sliding Calcs                 |             |                  | Strength Level          | psi =  | 7.9              |    |    |  |
| Lateral Sliding Force         | =           | 561.5 lbs        | ShearAllowable          | psi =  | 75.0             |    |    |  |
| less 100% Passive Force       | ə -         | 187.5 lbs        | Anet (Masonry)          | in2 =  |                  |    |    |  |
| less 100% Friction Force      | = -         | 661.7 lbs        | Wall Weight             | psf =  | 100.0            |    |    |  |
| Added Force Reg'd             | =           | 0.0 lbs OK       | Rebar Depth 'd'         | in =   | 6.25             |    |    |  |
| for 1.5 Stability             | =           | 0.0 lbs OK       |                         |        |                  |    |    |  |
| -                             |             |                  | Masonry Data            |        |                  |    |    |  |
| Vertical component of active  | e lateral   | soil pressure IS | f'm                     | psi =  |                  |    |    |  |
| NOT considered in the calcu   | ulation o   | of soil bearing  | Fs                      | psi =  |                  |    |    |  |
| Lood Fostons                  |             |                  | Solid Grouting          | =      |                  |    |    |  |
| Load Factors<br>Building Code |             |                  | Modular Ratio 'n'       | =      |                  |    |    |  |
| Dead Load                     |             | 1 200            | Equiv. Solid Thick.     | =      |                  |    |    |  |
| Live Load                     |             | 1.200            | Masonry Block Type      | =      |                  |    |    |  |
| Earth H                       |             | 1.600            | Masonry Design Method   | =      | ASD              |    |    |  |
| Wind W                        |             | 1.600            | Concrete Data           | nsi –  | 2 500 0          |    |    |  |
| Seismic. E                    |             | 1.000            | Fv                      | psi =  | 60,000,0         |    |    |  |
|                               |             |                  | - 3                     | 201-   |                  |    |    |  |

Printed: 19 SEP 2022, 3:11PM

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 DESCRIPTION: SE Den/Guest Rm (9/S3.2)

#### **Concrete Stem Rebar Area Details**

| Bottom Stem                      | Vertical Reinforcing | Horizontal Reinforcing                                       |  |  |
|----------------------------------|----------------------|--|--|--|
| As (based on applied moment) :   | 0.0315 in2/ft        |  |  |  |
| (4/3) * As :                     | 0.042 in2/ft         | Min Stem T&S Reinf Area 0.864 in2                            |  |  |
| 200bd/fy : 200(12)(6.25)/60000 : | 0.25 in2/ft          | Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft |  |  |
| 0.0018bh : 0.0018(12)(8) :       | 0.1728 in2/ft        | Horizontal Reinforcing Options :                             |  |  |
|                                  |                      | One layer of : Two layers of :                               |  |  |
| Required Area :                  | 0.1728 in2/ft        | #4@ 12.50 in #4@ 25.00 in                                    |  |  |
| Provided Area :                  | 0.2 in2/ft           | #5@ 19.38 in #5@ 38.75 in                                    |  |  |
| Maximum Area :                   | 0.8467 in2/ft        | #6@ 27.50 in #6@ 55.00 in                                    |  |  |
|                                  |                      |  |  |  |

#### **Footing Data**

| Toe Width             | =      | 0.42 ft         |
|-----------------------|--------|-----------------|
| Heel Width            | =      | 1.67            |
| Total Footing Width   | = _    | 2.09            |
| Footing Thickness     | =      | 12.00 in        |
| Key Width             | =      | 0.00 in         |
| Key Depth             | =      | 0.00 in         |
| Key Distance from Toe | e =    | 0.00 ft         |
| f'c = 2,500 psi       | Fy =   | 60,000 psi      |
| Footing Concrete Dens | sity = | 150.00 pcf      |
| Min. As %             | =      | 0.0000          |
| Cover @ Top 2.00      | ) @ E  | 3.00 in 3.00 in |

#### **Footing Design Results**

BYKONEN CARTER QUINN

|                       |             | <u>Toe</u>     | Heel        |    |
|-----------------------|-------------|----------------|-------------|----|
| Factored Pressure     | =           | 3,070          | 0 psf       |    |
| Mu' : Upward          | =           | 243            | 9 ft-#      |    |
| Mu' : Downward        | =           | 23             | 434 ft-#    |    |
| Mu: Design            | =           | 221 OK         | 425 ft-#    | OK |
| phiMn                 | =           | 7,663          | 2,500 ft-#  |    |
| Actual 1-Way Shear    | =           | 0.80           | 6.45 psi    |    |
| Allow 1-Way Shear     | =           | 75.00          | 40.00 psi   |    |
| Toe Reinforcing       | =           | # 4 @ 12.00 in |             |    |
| Heel Reinforcing      | =           | None Spec'd    |             |    |
| Key Reinforcing       | =           | None Spec'd    |             |    |
| Footing Torsion, Tu   |             | =              | 0.00 ft-lbs |    |
| Footing Allow. Torsio | 0.00 ft-lbs |                |             |    |
|                       |             |                | _           |    |

#### If torsion exceeds allowable, provide

supplemental design for footing torsion.

#### Other Acceptable Sizes & Spacings

Toe: #4@ 300.53 in, #5@ 465.82 in, #6@ 661.16 in, #7@ 864.00 in, #8@ 864.00 in, #9@ 864.00 in, #10@ 864.00 in

Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm

Key: No key defined

| Min footing T&S reinf Area          | 0.54       | in2                     |
|-------------------------------------|------------|-------------------------|
| Min footing T&S reinf Area per foot | 0.26       | in2 /ft                 |
| If one layer of horizontal bars:    | If two lay | ers of horizontal bars: |
| #4@ 9.26 in                         | #4@ 1      | 8.52 in                 |
| #5@ 14.35 in                        | #5@ 2      | 8.70 in                 |
| #6@ 20.37 in                        | #6@ 4      | 0.74 in                 |

## Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

Printed: 19 SEP 2022, 3:11PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: SE Den/Guest Rm (9/S3.2)

#### Summary of Overturning & Resisting Forces & Moments

|   |         | OV           | ERTURNIN       | G              |  | RE              | ESISTING        |                |
|---|---------|--------------|----------------|----------------|--|-----------------|-----------------|----------------|
| Item  |         | Force<br>lbs | Distance<br>ft | Moment<br>ft-# |  | Force<br>Ibs    | Distance<br>ft  | Moment<br>ft-# |
| HL Act Pres (ab water tb                      | D       | 500.0        | 1.67           | 833.3          | Soil Over HL (ab. water tbl)                 | 520.2           | 1.59            | 825.4          |
| HL Act Pres (be water tb<br>Hydrostatic Force | l)      |              |                |                | Soil Over HL (bel. water tbl)<br>Watre Table |                 | 1.59            | 825.4          |
| Buoyant Force                                 | =       |              |                |                | Sloped Soil Over Heel =                      |                 |                 |                |
| Surcharge over Heel                           | =       | 61.5         | 2.50           | 153.8          | Surcharge Over Heel =                        | 40.0            | 1.59            | 63.5           |
| Surcharge Over Toe                            | =       |              |                |                | Adjacent Footing Load =                      |                 |                 |                |
| Adjacent Footing Load                         | =       |              |                |                | Axial Dead Load on Stem =                    | 120.0           | 0.75            | 90.4           |
| Added Lateral Load                            | =       |              |                |                | * Axial Live Load on Stem =                  | 40.0            | 0.75            | 30.1           |
| Load @ Stem Above Soi                         | il =    |              |                |                | Soil Over Toe =                              | 27.3            | 0.21            | 5.7            |
|   | =       |              |                |                | Surcharge Over Toe =                         |                 |                 |                |
|   |         |              |                |                | Stem Weight(s) =                             | 450.0           | 0.75            | 339.0          |
|   |         |              |                |                | Earth @ Stem Transitions =                   |                 |                 |                |
| Total   | =       | 561.5        | O.T.M. =       | 987.2          | Footing Weight =                             | 313.1           | 1.04            | 326.7          |
|   |         |              |                |                | Key Weight =                                 |                 |                 |                |
| Resisting/Overturning                         | g Ratio | D            | =              | 1.67           | Vert. Component =                            |                 |                 |                |
| Vertical Loads used f                         | or Soil | Pressure     | = 1,510        | .5 lbs         | Total =                                      | 1,470.5         | bs <b>R.M.=</b> | 1,650.7        |
|   |         |              |                |                | * Axial live load NOT included in            | n total display | ed, or used fo  | r overturning  |

Axial live load NOT included in total displayed, or used for overtui resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus                     | 250.0 | pci |
|--|-------|-----|
| Horizontal Defl @ Top of Wall (approximate only) | 0.131 | in  |

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Printed: 19 SEP 2022, 3:11PM **Cantilevered Retaining Wall** Project File: Foundations.ec6 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022 **DESCRIPTION:** SE Den/Guest Rm (9/S3.2) **Rebar Lap & Embedment Lengths Information** Stem Design Segment: Bottom Stem Design Height: 0.00 ft above top of footing Lap Splice length for #4 bar specified in this stem design segment = 18.72 in Development length for #4 bar specified in this stem design segment = 14.40 in Hooked embedment length into footing for #4 bar specified in this stem design segment = 7.26 in As Provided = 0.2000 in2/ft As Required = 0.1728 in2/ft

Printed: 19 SEP 2022, 3:11PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |

DESCRIPTION: SE Den/Guest Rm (9/S3.2)



Printed: 19 SEP 2022, 3:11PM



DESCRIPTION: SE Den/Guest Rm (9/S3.2)



Printed: 19 SEP 2022, 3:10PM

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 DESCRIPTION: Garage/ADU Step (12/S3.2)

#### Code Reference:

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

#### Criteria

| Soil | D | ata |
|------|---|-----|
|      | ~ |     |

| = | 6.00 ft          |
|---|------------------|
| = | 0.00 ft          |
| = | 0.00             |
| = | 6.00 in          |
| = | 0.0 ft           |
|   | =<br>=<br>=<br>= |

### Surcharge Loads

| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Over | g & C<br>=<br>rturr | 40.0 psf<br>Dverturning<br>40.0<br>hing |  |
|--|---------------------|---|--|
| Axial Load Applied to Stem   |                     |   |  |
| Axial Dead Load<br>Axial Live Load   | =                   | 840.0 lbs<br>560.0 lbs                  |  |
| Axial Load Eccentricity  | =                   | 0.0 in                                  |  |

#### **Earth Pressure Seismic Load**

Method : Uniform Multiplier Used 9.000 = (Multiplier used on soil density)

| Allow Soil Bearing<br>Equivalent Fluid Pressure | =<br>Meth | 5,332.0<br>od | psf    |
|---|-----------|---------------|--------|
| Active Heel Pressure                            | =         | 40.0          | psf/ft |
|   | =         |               |        |
| Passive Pressure                                | =         | 300.0         | psf/ft |
| Soil Density, Heel                              | =         | 130.00        | pcf    |
| Soil Density, Toe                               | =         | 130.00        | pcf    |
| Footing  Soil Friction                          | =         | 0.450         |        |
| Soil height to ignore<br>for passive pressure   | =         | 12.00         | in     |

BYKONEN CARTER QUINN

#### Lateral Load Applied to Stem

| Lateral Load<br>Height to Top<br>Height to Bottom | =<br>=<br>= | 0.0 #/ft<br>0.00 ft<br>0.00 ft |
|---|-------------|--------------------------------|
| Load Type   | =           | Wind (W)<br>(Service Level)    |
| Wind on Exposed Stem (Strength Level)             | =           | 0.0 psf                        |



#### **Adjacent Footing Load**

| Adjacent Footing Load                    | = | 0.0 lbs        |
|--|---|----------------|
| Footing Width                            | = | 0.00 ft        |
| Eccentricity                             | = | 0.00 in        |
| Wall to Ftg CL Dist                      | = | 0.00 ft        |
| Footing Type                             |   | Spread Footing |
| Base Above/Below Soil<br>at Back of Wall | = | 0.0 ft         |
|  |   |                |

#### Uniform Seismic Force = 63.000 Total Seismic Force = 441.000



Printed: 19 SEP 2022, 3:10PM

Project File: Foundations.ec6

#### Cantilevered Retaining Wall LIC# : KW-06015393, Build:20.22.7.14

#### BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: Garage/ADU Step (12/S3.2)

| Design Summary                  |           | St                                     | em Construction          |        | Bottom   |    |    |  |
|---------------------------------|-----------|--|--------------------------|--------|----------|----|----|--|
|                                 |           |  | Design Height Above Ftg  |        | Stem OK  |    |    |  |
| Wall Stability Ratios           |           |  | Wall Material Above "Ht" |        | Concrete |    |    |  |
| Overturning                     | =         | 1.99 OK                                | Design Method            | _      | SD       | SD | SD |  |
| Sliding                         | =         | 1.26 Ratio < 1.5!                      | Thickness                | =      | 8.00     | 02 | 02 |  |
| Global Stability                | =         | 1.45                                   | Rebar Size               | =      | # 4      |    |    |  |
|                                 |           | -                                      | Rebar Spacing            | =      | 12.00    |    |    |  |
| Total Bearing Load              | =         | 3,176 lbs                              | Rebar Placed at          | =      | Edge     |    |    |  |
| resultant ecc.                  | =         | 6.60 in                                | Design Data              |        |          |    |    |  |
| Eccentricity outsi              | de mio    | dle third                              | fb/FB + fa/Fa            | =      | 0.700    |    |    |  |
| Soil Pressure @ Loe             | =         | 1,969 psf OK                           | Total Force @ Section    |        |          |    |    |  |
|                                 | =         | U psi UK                               | Service Level            | lbs =  |          |    |    |  |
| Allowable<br>Soil Prossure Loss | =<br>Thon | JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ | Strength Level           | lbs =  | 1,648.2  |    |    |  |
| ACL Eactored @ Toe              |           | 2 756 nef                              | MomentActual             |        |          |    |    |  |
| ACI Factored @ Heel             | _         | 0 psf                                  | Service Level            | ft-# = |          |    |    |  |
| Footing Shear @ Toe             | _         | 23.5 nei OK                            | Strength Level           | ft-# = | 3,792.5  |    |    |  |
| Footing Shear @ Heel            | _         | 20.0 psi OK                            | MomentAllowable          | =      | 5,412.6  |    |    |  |
|                                 | _         | 75.0 psi                               | ShearActual              |        |          |    |    |  |
| Allowable                       | -         | 70.0 p3i                               | Service Level            | psi =  |          |    |    |  |
| Sliding Calcs                   |           |  | Strength Level           | psi =  | 22.0     |    |    |  |
| Lateral Sliding Force           | =         | 1,374.9 lbs                            | ShearAllowable           | psi =  | 75.0     |    |    |  |
| less 100% Passive Force         | ə -       | 340.2 lbs                              | Anet (Masonry)           | in2 =  |          |    |    |  |
| less 100% Friction Force        | : = -     | 1,388.3 lbs                            | Wall Weight              | psf =  | 100.0    |    |    |  |
| Added Force Req'd               | =         | 0.0 lbs OK                             | Rebar Depth 'd'          | in =   | 6.25     |    |    |  |
| for 1.5 Stability               | =         | 333.8 lbs NG                           |                          |        |          |    |    |  |
| -                               |           |  | Masonry Data             |        |          |    |    |  |
| Vertical component of active    | e later   | al soil pressure IS                    | f'm                      | psi =  |          |    |    |  |
| NOT considered in the calcu     | ulation   | of soil bearing                        | Fs                       | psi =  |          |    |    |  |
| <b>F</b>                        |           |  | Solid Grouting           | =      |          |    |    |  |
| Load Factors                    |           |  | Modular Ratio 'n'        | =      |          |    |    |  |
| Dead Load                       |           | 1 200                                  | Equiv. Solid Thick.      | =      |          |    |    |  |
| Live Load                       |           | 1.200                                  | Masonry Block Type       | =      |          |    |    |  |
| Farth H                         |           | 1.600                                  | wasonry Design Method    | =      | ASD      |    |    |  |
| Wind W                          |           | 1.600                                  | Concrete Data            | nsi –  | 2 500 0  |    |    |  |
| Seismic. E                      |           | 1.000                                  | Fv                       | psi =  | 60,000,0 |    |    |  |
|                                 |           |  | • ,                      | P01 -  | 30,000.0 |    |    |  |

Printed: 19 SEP 2022, 3:10PM

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 **DESCRIPTION:** Garage/ADU Step (12/S3.2)

#### **Concrete Stem Rebar Area Details**

Bottom Stem Vertical Reinforcing Horizontal Reinforcing As (based on applied moment) : 0.1421 in2/ft (4/3) \* As : 0.1895 in2/ft Min Stem T&S Reinf Area 1.152 in2 200bd/fy: 200(12)(6.25)/60000: 0.25 in2/ft 0.0018bh : 0.0018(12)(8) : 0.1728 in2/ft Horizontal Reinforcing Options : Two layers of : One layer of : \_\_\_\_\_ Required Area : #4@ 12.50 in #4@ 25.00 in 0.1895 in2/ft Provided Area : 0.2 in2/ft #5@ 19.38 in #5@ 38.75 in Maximum Area : 0.8467 in2/ft #6@ 27.50 in #6@ 55.00 in

#### **Footing Data**

| Toe Width           | =        | 2      | .00 ft  |
|---------------------|----------|--------|---------|
| Heel Width          | =        | 1      | .25     |
| Total Footing Width | า =      | 3      | .25     |
| Footing Thickness   | =        | 12     | .00 in  |
| Key Width           | =        | 0      | .00 in  |
| Key Depth           | =        | 0      | .00 in  |
| Key Distance from   | Toe =    | 0      | .00 ft  |
| f'c = 2,500 ps      | si Fy:   | = 60,0 | )00 psi |
| Footing Concrete D  | ensity = | 150    | .00 pcf |
| Min. As %           | =        | 0.00   | 000     |
| Cover @ Top         | 2.00 @   | Btm.=  | 3.00 in |

BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

Project File: Foundations.ec6

Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft

#### **Footing Design Results**

|                       |      | <u>Toe</u>     | <u>Heel</u> |    |
|-----------------------|------|----------------|-------------|----|
| Factored Pressure     | =    | 2,756          | 0 psf       |    |
| Mu' : Upward          | =    | 4,373          | 25 ft-#     |    |
| Mu': Downward         | =    | 644            | 639 ft-#    |    |
| Mu: Design            | =    | 3,729 OK       | 614 ft-#    | OK |
| phiMn                 | =    | 7,663          | 2,500 ft-#  |    |
| Actual 1-Way Shear    | =    | 23.51          | 10.88 psi   |    |
| Allow 1-Way Shear     | =    | 75.00          | 40.00 psi   |    |
| Toe Reinforcing       | =    | # 4 @ 12.00 in |             |    |
| Heel Reinforcing      | =    | None Spec'd    |             |    |
| Key Reinforcing       | =    | None Spec'd    |             |    |
| Footing Torsion, Tu   |      | =              | 0.00 ft-lbs |    |
| Footing Allow. Torsio | n, p | ohi Tu =       | 0.00 ft-lbs |    |

#### If torsion exceeds allowable, provide

supplemental design for footing torsion.

#### Other Acceptable Sizes & Spacings

Toe: #4@ 17.76 in, #5@ 27.54 in, #6@ 39.09 in, #7@ 53.30 in, #8@ 70.18 in, #9@ 88.84 in, #10@ 112.83 in

Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm

Key: No key defined

| 0.84              | in2  |
|-------------------|--|
| 0.26              | in2 /ft  |
| <u>lf two lay</u> | ers of horizontal bars:                                      |
| #4@ 1             | 8.52 in  |
| #5@ 2             | 8.70 in  |
| #6@ 4             | 0.74 in  |
|                   | 0.84<br>0.26<br><u>If two lay</u><br>#4@ 1<br>#5@ 2<br>#6@ 4 |

Printed: 19 SEP 2022, 3:10PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: Garage/ADU Step (12/S3.2)

#### Summary of Overturning & Resisting Forces & Moments

| OVERTURNING                                   |        |              |                | F              | ESISTING   |                |                  |                |
|---|--------|--------------|----------------|----------------|--|----------------|------------------|----------------|
| Item  |        | Force<br>lbs | Distance<br>ft | Moment<br>ft-# |  | Force<br>lbs   | Distance<br>ft   | Moment<br>ft-# |
| HL Act Pres (ab water tb                      |        | 980.0        | 2.33           | 2.286.7        | Soil Over HL (ab. water tbl)                     | 455.0          | 2.96             | 1,346.0        |
| HL Act Pres (be water tb<br>Hydrostatic Force | l)     |              |                | _,             | Soil Over HL (bel. water tbl)<br>Watre Table     |                | 2.96             | 1,346.0        |
| Buovant Force                                 | =      |              |                |                | Sloped Soil Over Heel =                          |                |                  |                |
| Surcharge over Heel                           | =      | 86.2         | 3.50           | 301.5          | Surcharge Over Heel =<br>Adiacent Footing Load = | 23.3           | 2.96             | 69.0           |
| Adjacent Footing Load                         | =      |              |                |                | Axial Dead Load on Stem =                        | 840.0          | 2.33             | 1.960.0        |
| Added Lateral Load                            | _      |              |                |                | * Axial Live Load on Stem =                      | 560.0          | 2.33             | 1,306.7        |
| Load @ Stem Above Soi                         |        |              |                |                | Soil Over Toe =                                  | 130.0          | 1.00             | 130.0          |
| Seismic Farth Load                            | =      | 308.7        | 3.50           | 1.080.5        | Surcharge Over Toe =                             | 80.0           | 1.00             | 80.0           |
|   | _      |              | 0.00           | .,             | Stem Weight(s) =                                 | 600.0          | 2.33             | 1,400.0        |
|   |        |              |                |                | Earth @ Stem Transitions =                       |                |                  |                |
| Total   | =      | 1,374.9      | O.T.M. =       | 3,668.7        | Footing Weight =                                 | 487.5          | 1.63             | 792.2          |
|   |        |              |                |                | Key Weight =                                     |                |                  |                |
| Resisting/Overturnin                          | g Rati | io           | =              | 1.99           | Vert. Component =                                | 469.2          | 3.25             | 1,525.0        |
| Vertical Loads used f                         | or Soi | Pressure     | = 3,175.8      | 3 lbs          | Total =  | 3,085.1        | lbs <b>R.M.=</b> | 7,302.2        |
|   |        |              |                |                | * Axial live load NOT included i                 | n total displa | yed, or used fo  | r overturning  |

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus250.0pciHorizontal Defl @ Top of Wall (approximate only)0.101in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Axial live load NOT included in total displayed, or used for over resistance, but is included for soil pressure calculation.

Printed: 19 SEP 2022, 3:10PM **Cantilevered Retaining Wall** Project File: Foundations.ec6 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022 **DESCRIPTION:** Garage/ADU Step (12/S3.2) **Rebar Lap & Embedment Lengths Information** Stem Design Segment: Bottom Stem Design Height: 0.00 ft above top of footing Lap Splice length for #4 bar specified in this stem design segment = 18.72 in Development length for #4 bar specified in this stem design segment = 14.40 in Hooked embedment length into footing for #4 bar specified in this stem design segment = 7.96 in 0.2000 in2/ft As Provided = As Required = 0.1895 in2/ft

Printed: 19 SEP 2022, 3:10PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |

**DESCRIPTION:** Garage/ADU Step (12/S3.2)



Printed: 19 SEP 2022, 3:10PM



**DESCRIPTION:** Garage/ADU Step (12/S3.2)



Printed: 19 SEP 2022, 3:09PM

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 DESCRIPTION: Garage/ADU Step (12/S3.2)

#### Code Reference:

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

#### Criteria

#### Soil Data

| Retained Height         | = | 6.00 ft |
|-------------------------|---|---------|
| Wall height above soil  | = | 0.00 ft |
| Slope Behind Wall       | = | 0.00    |
| Height of Soil over Toe | = | 6.00 in |
| Water height over heel  | = | 0.0 ft  |

## Surcharge Loads

| Surcharge Over Heel = 40.0 psf<br>Used To Resist Sliding & Overturning<br>Surcharge Over Toe = 40.0<br>Used for Sliding & Overturning |  |  |  |  |  |
|---|--|--|--|--|--|
| Axial Load Applied to Stem  |  |  |  |  |  |
| Axial Dead Load = 840.0 lbs   |  |  |  |  |  |

|                         | _ | 0-0.0 100 |
|-------------------------|---|-----------|
| Axial Live Load         | = | 560.0 lbs |
| Axial Load Eccentricity | = | 0.0 in    |

| =<br>Meth | 4,000.0<br>od                      | psf  |
|-----------|------------------------------------|--|
| =         | 40.0                               | psf/ft   |
| =         |                                    |  |
| =         | 300.0                              | psf/ft   |
| =         | 130.00                             | pcf  |
| =         | 130.00                             | pcf  |
| =         | 0.450                              |  |
| =         | 12.00                              | in   |
|           | =<br>Meth<br>=<br>=<br>=<br>=<br>= | = 4,000.0<br>Method<br>= 40.0<br>= 300.0<br>= 130.00<br>= 130.00<br>= 0.450<br>= 12.00 |

BYKONEN CARTER QUINN

#### Lateral Load Applied to Stem

| Lateral Load<br>Height to Top<br>Height to Bottom | =<br>=<br>= | 0.0 #/ft<br>0.00 ft<br>0.00 ft |
|---|-------------|--------------------------------|
| Load Type   | =           | Wind (W)<br>(Service Level)    |
| Wind on Exposed Sten<br>(Strength Level)          | n =         | 0.0 psf                        |



#### Adjacent Footing Load

| Adjacent Footing Load                    | = | 0.0 lbs        |
|--|---|----------------|
| Footing Width                            | = | 0.00 ft        |
| Eccentricity                             | = | 0.00 in        |
| Wall to Ftg CL Dist                      | = | 0.00 ft        |
| Footing Type                             |   | Spread Footing |
| Base Above/Below Soil<br>at Back of Wall | = | 0.0 ft         |
| Poisson's Ratio                          | = | 0.300          |

Printed: 19 SEP 2022, 3:09PM

Project File: Foundations.ec6

#### Cantilevered Retaining Wall LIC# : KW-06015393, Build:20.22.7.14

#### BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: Garage/ADU Step (12/S3.2)

| Design Summary  | Stem Construction        | _        | Bottom   |    |    |  |
|---|--------------------------|----------|----------|----|----|--|
|   | Design Height Above Etg  |          | Stem OK  |    |    |  |
| Wall Stability Ratios                                 | Wall Material Above "Ht" | n =<br>_ | Concrete |    |    |  |
| Overturning = 2.82 OK                                 | Design Method            | _        | SD       | SD | SD |  |
| Sliding = 1.62 OK                                     | Thickness                | _        | 8.00     | 00 | 00 |  |
| Global Stability = 1.45                               | Rebar Size               | =        | # 4      |    |    |  |
|   | Rebar Spacing            | =        | 12.00    |    |    |  |
| Total Bearing Load = 3.176 lbs                        | Rebar Placed at          | =        | Edge     |    |    |  |
| $\dots$ resultant ecc. = 2.51 in                      | Design Data              |          |          |    |    |  |
| Eccentricity within middle third                      | fb/FB + fa/Fa            | =        | 0.491    |    |    |  |
| Soil Pressure @ Toe = 1,355 psf OK                    | Total Force @ Section    |          |          |    |    |  |
| Soli Pressure @ Heel = 599 psr OK                     | Service Level            | lbs =    |          |    |    |  |
| Allowable = 4,000 psf                                 | Strength Level           | lbs =    | 1,270.2  |    |    |  |
| ACI Eastarad @ Tag 1 807 paf                          | MomentActual             |          |          |    |    |  |
| ACI Factored @ Heel = 1,097 psi                       | Service Level            | ft-# =   |          |    |    |  |
| Footing Chaor @ Too                                   | Strength Level           | ft-# =   | 2,658.5  |    |    |  |
| Footing Shear @ Hool = 17.0 psi OK                    | MomentAllowable          | =        | 5,412.6  |    |    |  |
|   | ShearActual              |          |          |    |    |  |
| Allowable = 75.0 psi                                  | Service Level            | psi =    |          |    |    |  |
| Sliding Calcs   | Strength Level           | psi =    | 16.9     |    |    |  |
| Lateral Sliding Force – 1 066 2 lbs                   | ShearAllowable           | psi =    | 75.0     |    |    |  |
| less 100% Passive Force - 340.2 lbs                   | Anet (Masonry)           | in2 =    |          |    |    |  |
| less 100% Friction Force = $-1.388.3$ lbs             | Wall Weight              | psf=     | 100.0    |    |    |  |
| Added Force Reg'd = 0.0 lbs OK                        | Rebar Depth 'd'          | in =     | 6 25     |    |    |  |
| for 1.5 Stability = $0.0$ lbs OK                      |                          |          | 0.20     |    |    |  |
| ,   | Masonry Data             |          |          |    |    |  |
| Vertical component of active lateral soil pressure IS | f'm                      | psi =    |          |    |    |  |
| NOT considered in the calculation of soil bearing     | Fs                       | psi =    |          |    |    |  |
|   | Solid Grouting           |          |          |    |    |  |
| Load Factors  | Modular Ratio 'n'        | =        |          |    |    |  |
| Building Code   | Equiv. Solid Thick.      | =        |          |    |    |  |
| Live Lead 1.200                                       | Masonry Block Type       | =        |          |    |    |  |
| Live Load 1.600                                       | Masonry Design Method    | =        | ASD      |    |    |  |
| Eann, H 1.600   | Concrete Data            |          |          |    |    |  |
| VVINA, VV 1.600                                       | ťc                       | psi =    | 2,500.0  |    |    |  |
| Seismic, E 1.000                                      | ⊢у                       | psi =    | 60,000.0 |    |    |  |

Printed: 19 SEP 2022, 3:09PM

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 DESCRIPTION: Garage/ADU Step (12/S3.2)

#### **Concrete Stem Rebar Area Details**

Bottom Stem As (based on applied moment) : (4/3) \* As : 200bd/fy : 200(12)(6.25)/60000 : 0.0018bh : 0.0018(12)(8) :

Required Area : Provided Area : Maximum Area :

#### **Footing Data**

| Toe Width            | = 2.        | 00 ft     |
|----------------------|-------------|-----------|
| Heel Width           | = <u>1.</u> | <u>25</u> |
| Total Footing Width  | = 3.        | 25        |
| Footing Thickness    | = 12.       | 00 in     |
| Key Width            | = 0.        | 00 in     |
| Key Depth            | = 0.        | 00 in     |
| Key Distance from To | e = 0.      | 00 ft     |
| f'c = 2,500 psi      | Fy = 60,00  | 00 psi    |
| Footing Concrete Den | sity = 150. | 00 pcf    |
| Min. As %            | = 0.000     | 00        |
| Cover @ Top 2.0      | 0 @ Btm.=   | 3.00 in   |

#### BYKONEN CARTER QUINN

Vertical Reinforcing

0.0996 in2/ft

0.1328 in2/ft

0.1728 in2/ft

0.1728 in2/ft

0.8467 in2/ft

0.2 in2/ft

\_\_\_\_\_

0.25 in2/ft

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

#### Horizontal Reinforcing

 Min Stem T&S Reinf Area 1.152 in2

 Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft

 Horizontal Reinforcing Options :

 One layer of :
 Two layers of :

 #4@ 12.50 in
 #4@ 25.00 in

 #5@ 19.38 in
 #5@ 38.75 in

 #6@ 27.50 in
 #6@ 55.00 in

#### **Footing Design Results**

|                       |      | <u>Toe</u>     | <u>Heel</u> |    |
|-----------------------|------|----------------|-------------|----|
| Factored Pressure     | =    | 1,897          | 839 psf     |    |
| Mu' : Upward          | =    | 3,360          | 154 ft-#    |    |
| Mu' : Downward        | =    | 644            | 639 ft-#    |    |
| Mu: Design            | =    | 2,716 OK       | 485 ft-#    | OK |
| phiMn                 | =    | 7,663          | 2,500 ft-#  |    |
| Actual 1-Way Shear    | =    | 16.95          | 7.45 psi    |    |
| Allow 1-Way Shear     | =    | 75.00          | 40.00 psi   |    |
| Toe Reinforcing       | =    | # 4 @ 12.00 in |             |    |
| Heel Reinforcing      | =    | None Spec'd    |             |    |
| Key Reinforcing       | =    | None Spec'd    |             |    |
| Footing Torsion, Tu   |      | =              | 0.00 ft-lbs |    |
| Footing Allow. Torsio | n, p | ohi Tu 🛛 =     | 0.00 ft-lbs |    |
|                       |      |                |             |    |

#### If torsion exceeds allowable, provide

supplemental design for footing torsion.

#### Other Acceptable Sizes & Spacings

Toe: #4@ 24.40 in, #5@ 37.82 in, #6@ 53.68 in, #7@ 73.20 in, #8@ 96.38 in, #9@ 122.00 in, #10@ 154.94 in

Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm

Key: No key defined

| 0.84              | in2  |
|-------------------|--|
| 0.26              | in2 /ft  |
| <u>lf two lay</u> | ers of horizontal bars:                                      |
| #4@ 1             | 8.52 in  |
| #5@ 2             | 8.70 in  |
| #6@ 4             | 0.74 in  |
|                   | 0.84<br>0.26<br><u>If two lay</u><br>#4@ 1<br>#5@ 2<br>#6@ 4 |

Printed: 19 SEP 2022, 3:09PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: Garage/ADU Step (12/S3.2)

#### Summary of Overturning & Resisting Forces & Moments

|  |       | OV           | <b>ERTURNING</b> | i              |  | RE           | SISTING        |                |
|--|-------|--------------|------------------|----------------|--|--------------|----------------|----------------|
| Item   |       | Force<br>Ibs | Distance<br>ft   | Moment<br>ft-# |  | Force<br>Ibs | Distance<br>ft | Moment<br>ft-# |
| HL Act Pres (ab water th                       | d)    | 980.0        | 2.33             | 2.286.7        | Soil Over HL (ab. water tbl)                     | 455.0        | 2.96           | 1,346.0        |
| HL Act Pres (be water the<br>Hydrostatic Force | l)    |              |                  | _,             | Soil Over HL (bel. water tbl)<br>Watre Table     |              | 2.96           | 1,346.0        |
| Buovant Force                                  | =     |              |                  |                | Sloped Soil Over Heel =                          |              |                |                |
| Surcharge over Heel                            | =     | 86.2         | 3.50             | 301.5          | Surcharge Over Heel =<br>Adjacent Footing Load = | 23.3         | 2.96           | 69.0           |
| Adjacent Footing Load                          | _     |              |                  |                | Axial Dead Load on Stem =                        | 840.0        | 2.33           | 1,960.0        |
| Added Lateral Load                             | =     |              |                  |                | * Axial Live Load on Stem =                      | 560.0        | 2.33           | 1,306.7        |
| Load @ Stem Above So                           | il =  |              |                  |                | Soil Over Toe =                                  | 130.0        | 1.00           | 130.0          |
|  | =     |              |                  |                | Surcharge Over Toe =                             | 80.0         | 1.00           | 80.0           |
|  |       |              |                  |                | Stem Weight(s) =                                 | 600.0        | 2.33           | 1,400.0        |
|  |       |              |                  |                | Earth @ Stem Transitions =                       |              |                |                |
| Total  | =     | 1,066.2      | O.T.M. =         | 2,588.2        | Footing Weight =                                 | 487.5        | 1.63           | 792.2          |
|  |       |              |                  |                | Key Weight =                                     |              |                |                |
| Resisting/Overturnin                           | g Rat | io           | =                | 2.82           | Vert. Component =                                | 469.2        | 3.25           | 1,525.0        |
| Vertical Loads used f                          | or So | il Pressure  | = 3,175.         | 8 lbs          | Total =  | 3,085.1 l    | bs R.M.=       | 7,302.2        |

Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus250.0pciHorizontal Defl @ Top of Wall (approximate only)0.069in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe.

because the wall would then tend to rotate into the retained soil.

Printed: 19 SEP 2022, 3:09PM **Cantilevered Retaining Wall** Project File: Foundations.ec6 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022 **DESCRIPTION:** Garage/ADU Step (12/S3.2) **Rebar Lap & Embedment Lengths Information** Stem Design Segment: Bottom Stem Design Height: 0.00 ft above top of footing Lap Splice length for #4 bar specified in this stem design segment = 18.72 in Development length for #4 bar specified in this stem design segment = 14.40 in Hooked embedment length into footing for #4 bar specified in this stem design segment = 7.26 in 0.2000 in2/ft As Provided = As Required = 0.1728 in2/ft

Printed: 19 SEP 2022, 3:09PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |

**DESCRIPTION:** Garage/ADU Step (12/S3.2)



Printed: 19 SEP 2022, 3:09PM



**DESCRIPTION:** Garage/ADU Step (12/S3.2)



#### Printed: 19 SEP 2022, 5:58PM

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

## **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 DESCRIPTION: SE @ ADU/Laundry (12/S3.1)

#### Code Reference:

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

#### Criteria

| Soil | Data |
|------|------|
|      |      |

| Retained Height         | = | 6.50 ft |
|-------------------------|---|---------|
| Wall height above soil  | = | 0.67 ft |
| Slope Behind Wall       | = | 0.00    |
| Height of Soil over Toe | = | 4.00 in |
| Water height over heel  | = | 0.0 ft  |

#### Surcharge Loads

| Surcharge Over Heel = 40.0 psf<br>Used To Resist Sliding & Overturning<br>Surcharge Over Toe = 0.0<br>Used for Sliding & Overturning |     |                                  |  |  |  |  |  |
|--|-----|----------------------------------|--|--|--|--|--|
| Axial Load Applied to Stem   |     |                                  |  |  |  |  |  |
| Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity  | = = | 290.0 lbs<br>435.0 lbs<br>0.0 in |  |  |  |  |  |

#### Earth Pressure Seismic Load

Method : Uniform Multiplier Used = 9.000 (Multiplier used on soil density)

| Allow Soil Bearing<br>Equivalent Fluid Pressure | =<br>Meth | 5,332.0<br>od | psf    |
|---|-----------|---------------|--------|
| Active Heel Pressure                            | =         | 40.0          | psf/ft |
|   | =         |               |        |
| Passive Pressure                                | =         | 300.0         | psf/ft |
| Soil Density, Heel                              | =         | 130.00        | pcf    |
| Soil Density, Toe                               | =         | 130.00        | pcf    |
| Footing  Soil Friction                          | =         | 0.450         |        |
| Soil height to ignore<br>for passive pressure   | =         | 0.00          | in     |

BYKONEN CARTER QUINN

#### Lateral Load Applied to Stem

| Lateral Load<br>Height to Top<br>Height to Bottom | =<br>=<br>= | 0.0 #/ft<br>0.00 ft<br>0.00 ft |
|---|-------------|--------------------------------|
| Load Type   | =           | Wind (W)<br>(Service Level)    |
| Wind on Exposed Stem (Strength Level)             | =           | 0.0 psf                        |

| • • | • |
|-----|---|

#### **Adjacent Footing Load**

| Adjacent Footing Load                    | = | 0.0 lbs        |
|--|---|----------------|
| Footing Width                            | = | 0.00 ft        |
| Eccentricity                             | = | 0.00 in        |
| Wall to Ftg CL Dist                      | = | 0.00 ft        |
| Footing Type                             |   | Spread Footing |
| Base Above/Below Soil<br>at Back of Wall | = | 0.0 ft         |
| Poisson's Ratio                          | _ | 0 300          |

#### Uniform Seismic Force = 67.500 Total Seismic Force = 506.250

Printed: 19 SEP 2022, 5:58PM

Project File: Foundations.ec6

#### Cantilevered Retaining Wall LIC# : KW-06015393, Build:20.22.7.14

#### BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: SE @ ADU/Laundry (12/S3.1)

| Design Summary                  |           |                     | Stem Construction        | _      | Bottom           |    |    |  |
|---------------------------------|-----------|---------------------|--------------------------|--------|------------------|----|----|--|
|                                 |           |                     | Dosign Hoight Above Etc  |        | Stem OK          |    |    |  |
| Wall Stability Ratios           |           |                     | Wall Material Above "Ht" | 11=    | 0.00<br>Concrete |    |    |  |
| Overturning                     | =         | 2.44 OK             | Design Method            | _      | SD               | SD | SD |  |
| Sliding                         | =         | 1.37 Ratio < 1.5    | <sup>j</sup> Thickness   | _      | 8 00             | OD | 00 |  |
| Global Stability                | =         | 1.78                | Rebar Size               | =      | # 4              |    |    |  |
|                                 |           |                     | Rebar Spacing            | =      | 10.00            |    |    |  |
| Total Bearing Load              | =         | 4.085 lbs           | Rebar Placed at          | =      | Edge             |    |    |  |
| resultant ecc.                  | =         | 6.49 in             | Design Data              |        |                  |    |    |  |
| Eccentricity withi              | n mid     | dle third           | fb/FB + fa/Fa            | =      | 0.740            |    |    |  |
| Soil Pressure @ Toe             | =         | 1,447 psf OK        | Total Force @ Section    |        |                  |    |    |  |
| Soli Pressure @ Heel            | =         | 273 pst UK          | Service Level            | lbs =  |                  |    |    |  |
| Allowable<br>Soil Prossure Loss | =<br>Thon | 0,002 pst           | Strength Level           | lbs =  | 1,918.8          |    |    |  |
| ACI Eactored @ Toe              | -<br>-    | 2 026 nsf           | MomentActual             | e      |                  |    |    |  |
| ACI Factored @ Heel             | _         | 382 psf             | Service Level            | ft-# = |                  |    |    |  |
| Footing Shear @ Toe             | _         | 19.7 nei OK         | Strength Level           | ft-# = | 4,771.3          |    |    |  |
| Footing Shear @ Heel            | _         | 9.4 psi OK          | MomentAllowable          | =      | 6,444.1          |    |    |  |
|                                 | _         | 75.0 nsi            | ShearActual              |        |                  |    |    |  |
| Allowable                       | -         | 70.0 por            | Service Level            | psi =  |                  |    |    |  |
| Sliding Calcs                   |           |                     | Strength Level           | psi =  | 25.6             |    |    |  |
| Lateral Sliding Force           | =         | 1,571.7 lbs         | ShearAllowable           | psi =  | 75.0             |    |    |  |
| less 100% Passive Force         | ə -       | 266.7 lbs           | Anet (Masonry)           | in2 =  |                  |    |    |  |
| less 100% Friction Force        | = -       | 1,884.7 lbs         | Wall Weight              | psf =  | 100.0            |    |    |  |
| Added Force Reg'd               | =         | 0.0 lbs OK          | Rebar Depth 'd'          | in =   | 6.25             |    |    |  |
| for 1.5 Stability               | =         | 206.1 lbs NG        |                          |        |                  |    |    |  |
| -                               |           |                     | Masonry Data             |        |                  |    |    |  |
| Vertical component of active    | e later   | al soil pressure IS | f'm                      | psi =  |                  |    |    |  |
| NOT considered in the calcu     | ulation   | of soil bearing     | Fs                       | psi =  |                  |    |    |  |
|                                 |           |                     | Solid Grouting           | =      |                  |    |    |  |
| Load Factors                    |           |                     | Modular Ratio 'n'        | =      |                  |    |    |  |
| Dead Load                       |           | 1 200               | Equiv. Solid Thick.      | =      |                  |    |    |  |
| Live Load                       |           | 1.200               | Masonry Block Type       | =      |                  |    |    |  |
| Farth H                         |           | 1 600               | Iviasonry Design Method  | =      | ASD              |    |    |  |
| Wind W                          |           | 1 600               | Concrete Data            | nei –  | 2 500 0          |    |    |  |
| Seismic, F                      |           | 1.000               | Fv                       | psi=   | 2,300.0          |    |    |  |
|                                 |           |                     | ' y                      | P31 -  | 00,000.0         |    |    |  |

Printed: 19 SEP 2022, 5:58PM

#### Project File: Foundations.ec6

#### Cantilevered Retaining Wall LIC# : KW-06015393, Build:20.22.7.14

DESCRIPTION: SE @ ADU/Laundry (12/S3.1)

#### **Concrete Stem Rebar Area Details**

| Bottom Stem                      | Vertical Reinforcing | Horizontal Reinforcing                                       |
|----------------------------------|----------------------|--|
| As (based on applied moment) :   | 0.1788 in2/ft        |  |
| (4/3) * As :                     | 0.2383 in2/ft        | Min Stem T&S Reinf Area 1.376 in2                            |
| 200bd/fy : 200(12)(6.25)/60000 : | 0.25 in2/ft          | Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft |
| 0.0018bh : 0.0018(12)(8) :       | 0.1728 in2/ft        | Horizontal Reinforcing Options :                             |
|                                  |                      | One layer of : Two layers of :                               |
| Required Area :                  | 0.2383 in2/ft        | #4@ 12.50 in #4@ 25.00 in                                    |
| Provided Area :                  | 0.24 in2/ft          | #5@ 19.38 in #5@ 38.75 in                                    |
| Maximum Area :                   | 0.8467 in2/ft        | #6@ 27.50 in #6@ 55.00 in                                    |
|                                  |                      |  |

#### **Footing Data**

| Toe Width           | =        | 2.0   | 00 ft   |
|---------------------|----------|-------|---------|
| Heel Width          | =        | 2.    | 75      |
| Total Footing Width | =        | 4.    | 75      |
| Footing Thickness   | =        | 12.0  | 00 in   |
| Key Width           | =        | 0.0   | 00 in   |
| Key Depth           | =        | 0.0   | 00 in   |
| Key Distance from   | Toe =    | 0.0   | 00 ft   |
| f'c = 2,500 ps      | i Fy=    | 60,00 | 00 psi  |
| Footing Concrete D  | ensity = | 150.0 | 00 pcf  |
| Min. As %           | =        | 0.000 | 00      |
| Cover @ Top 2       | .00 @    | Btm.= | 3.00 in |

#### **Footing Design Results**

BYKONEN CARTER QUINN

|                       |      | <u>Toe</u>     | <u>Heel</u> |    |
|-----------------------|------|----------------|-------------|----|
| Factored Pressure     | =    | 2,026          | 382 psf     |    |
| Mu' : Upward          | =    | 3,591          | 1,350 ft-#  |    |
| Mu' : Downward        | =    | 464            | 2,730 ft-#  |    |
| Mu: Design            | =    | 3,127 OK       | 1,380 ft-#  | OK |
| phiMn                 | =    | 9,145          | 10,225 ft-# |    |
| Actual 1-Way Shear    | =    | 19.67          | 9.42 psi    |    |
| Allow 1-Way Shear     | =    | 75.00          | 75.00 psi   |    |
| Toe Reinforcing       | =    | # 4 @ 10.00 in |             |    |
| Heel Reinforcing      | =    | # 4 @ 10.00 in |             |    |
| Key Reinforcing       | =    | None Spec'd    |             |    |
| Footing Torsion, Tu   |      | =              | 0.00 ft-lbs |    |
| Footing Allow. Torsio | n, p | ohi Tu =       | 0.00 ft-lbs |    |

#### If torsion exceeds allowable, provide

supplemental design for footing torsion.

#### Other Acceptable Sizes & Spacings

Toe: #4@ 21.19 in, #5@ 32.85 in, #6@ 46.62 in, #7@ 63.58 in, #8@ 83.72 in, #9@ 105.97 in, #10@ 134.58 in

Heel: #4@ 53.88 in, #5@ 83.52 in, #6@ 118.55 in, #7@ 161.66 in, #8@ 212.86 in, #9@ 269.44 in, #10@ 342.19 in

Key: No key defined

| Min footing T&S reinf Area          | 1.23 in2                          |
|-------------------------------------|-----------------------------------|
| Vin footing T&S reinf Area per foot | 0.26 in2 /ft                      |
| f one layer of horizontal bars:     | If two layers of horizontal bars: |
| #4@ 9.26 in                         | #4@ 18.52 in                      |
| #5@ 14.35 in                        | #5@ 28.70 in                      |
| #6@ 20.37 in                        | #6@ 40.74 in                      |
|                                     |                                   |

(c) ENERCALC INC 1983-2022

Printed: 19 SEP 2022, 5:58PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: SE @ ADU/Laundry (12/S3.1)

#### Summary of Overturning & Resisting Forces & Moments

|   |        | OV            | ERTURNING      |                |   | RE                                  | SISTING                        |                |
|---|--------|---------------|----------------|----------------|---|-------------------------------------|--------------------------------|----------------|
| Item  |        | Force<br>lbs  | Distance<br>ft | Moment<br>ft-# |   | Force<br>lbs                        | Distance<br>ft                 | Moment<br>ft-# |
| HL Act Pres (ab water th                      | 1)     | 1.125.0       | 2.50           | 2.812.5        | Soil Over HL (ab. water tbl)                                      | 1,760.4                             | 3.71                           | 6,528.2        |
| HL Act Pres (be water tb<br>Hydrostatic Force | i)     | ,             |                |                | Soil Over HL (bel. water tbl)<br>Watre Table                      |                                     | 3.71                           | 6,528.2        |
| Buoyant Force                                 | =      |               |                |                | Sloped Soil Over Heel =   |                                     |                                |                |
| Surcharge over Heel                           | =      | 92.3          | 3.75           | 346.2          | Surcharge Over Heel =<br>Adjacent Footing Load =                  | 83.3                                | 3.71                           | 309.0          |
| Adjacent Footing Load                         | =      |               |                |                | Axial Dead Load on Stem =   | 290.0                               | 2.33                           | 676.7          |
| Added Lateral Load                            | =      |               |                |                | * Axial Live Load on Stem =                                       | 435.0                               | 2.33                           | 1,015.0        |
| Load @ Stem Above Sol                         | il =   |               |                |                | Soil Over Toe =   | 86.7                                | 1.00                           | 86.7           |
| Seismic Earth Load                            | =      | 354.4         | 3.75           | 1,328.9        | Surcharge Over Toe =  |                                     |                                |                |
|   | =      |               |                |                | Stem Weight(s) =  | 716.7                               | 2.33                           | 1,672.3        |
|   |        |               |                |                | Earth @ Stem Transitions =  |                                     |                                |                |
| Total   | =      | 1,571.7       | O.T.M. =       | 4,487.6        | Footing Weight =  | 712.5                               | 2.38                           | 1,692.2        |
|   |        |               |                |                | Key Weight =  |                                     |                                |                |
| Resisting/Overturnin                          | g Rati | io            | =              | 2.44           | Vert. Component =   |                                     |                                |                |
| Vertical Loads used f                         | or Soi | Pressure      | = 4,084.6      | 6 lbs          | Total =   | 3,649.6 lb                          | os <b>R.M.=</b>                | 10,965.1       |
| If seismic is included, th                    | e OTN  | ∕l and slidin | a ratios       |                | * Axial live load NOT included in resistance, but is included for | n total displaye<br>soil pressure o | ed, or used fo<br>calculation. | roverturning   |

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.061 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Printed: 19 SEP 2022, 5:58PM **Cantilevered Retaining Wall** Project File: Foundations.ec6 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022 DESCRIPTION: SE @ ADU/Laundry (12/S3.1) **Rebar Lap & Embedment Lengths Information** Stem Design Segment: Bottom Stem Design Height: 0.00 ft above top of footing Lap Splice length for #4 bar specified in this stem design segment = 18.72 in Development length for #4 bar specified in this stem design segment = 14.40 in Hooked embedment length into footing for #4 bar specified in this stem design segment = 8.34 in 0.2400 in2/ft As Provided = As Required = 0.2383 in2/ft

Printed: 19 SEP 2022, 5:58PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |

DESCRIPTION: SE @ ADU/Laundry (12/S3.1)



Printed: 19 SEP 2022, 5:58PM



**DESCRIPTION:** SE @ ADU/Laundry (12/S3.1)



Printed: 19 SEP 2022, 5:59PM

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 DESCRIPTION: SE @ ADU/Laundry (12/S3.1)

#### Code Reference:

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

#### Criteria

#### Soil Data

| = | 6.50 ft          |
|---|------------------|
| = | 0.67 ft          |
| = | 0.00             |
| = | 4.00 in          |
| = | 0.0 ft           |
|   | =<br>=<br>=<br>= |

#### Surcharge Loads

| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Over | g & O<br>=<br>erturn | 40.0 psf<br>verturning<br>0.0<br>ing |  |  |  |  |  |
|--|----------------------|--------------------------------------|--|--|--|--|--|
| Axial Load Applied to Stem   |                      |                                      |  |  |  |  |  |
| Axial Dead Load  | =                    | 290.0 lbs                            |  |  |  |  |  |

| Axial Live Load         | = | 435.0 lbs |
|-------------------------|---|-----------|
| Axial Load Eccentricity | = | 0.0 in    |

| Allow Soil Bearing<br>Equivalent Fluid Pressure | =<br>Meth | 4,000.0<br>od | psf    |
|---|-----------|---------------|--------|
| Active Heel Pressure                            | =         | 40.0          | psf/ft |
|   | =         |               |        |
| Passive Pressure                                | =         | 300.0         | psf/ft |
| Soil Density, Heel                              | =         | 130.00        | pcf    |
| Soil Density, Toe                               | =         | 130.00        | pcf    |
| Footing  Soil Friction                          | =         | 0.450         |        |
| Soil height to ignore<br>for passive pressure   | =         | 0.00          | in     |

BYKONEN CARTER QUINN

#### Lateral Load Applied to Stem

| Lateral Load<br>Height to Top<br>Height to Bottom | =<br>=<br>= | 0.0 #/ft<br>0.00 ft<br>0.00 ft |
|---|-------------|--------------------------------|
| Load Type   | =           | Wind (W)<br>(Service Level)    |
| Wind on Exposed Stem<br>(Strength Level)          | -           | 0.0 psf                        |

#### **Adjacent Footing Load**

| Adjacent Footing Load | = | 0.0 lbs        |
|-----------------------|---|----------------|
| Footing Width         | = | 0.00 ft        |
| Eccentricity          | = | 0.00 in        |
| Wall to Ftg CL Dist   | = | 0.00 ft        |
| Footing Type          |   | Spread Footing |
| Base Above/Below Soil |   | 0.0.#          |
| at Back of Wall       | = | 0.0 11         |

Printed: 19 SEP 2022, 5:59PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall** LIC# : KW-06015393, Build:20.22.7.14

#### BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: SE @ ADU/Laundry (12/S3.1)

| Design Summary                  |           |                  |         | Stem Construction        | _           | Bottom           |    |    |  |
|---------------------------------|-----------|------------------|---------|--------------------------|-------------|------------------|----|----|--|
|                                 |           |                  |         | Decign Height Above Etc  | - <u>.</u>  | Stem OK          |    |    |  |
| Wall Stability Ratios           |           |                  |         | Wall Material Above "Ht" | π=          | 0.00<br>Concrete |    |    |  |
| Overturning                     | =         | 3.47             | ОК      | Design Method            | =           | SD               | SD | SD |  |
| Sliding                         | =         | 1.77             | ÖK      | Thickness                | _           | 8.00             | 0D | 00 |  |
| Global Stability                | =         | 1 78             |         | Rebar Size               | =           | # 4              |    |    |  |
| Clobal Clability                |           | 1.10             |         | Rebar Spacing            | =           | 10.00            |    |    |  |
| Total Bearing Load              | =         | 4.085 lt         | วร      | Rebar Placed at          | =           | Edge             |    |    |  |
| resultant ecc.                  | =         | 2.58 ir          | 1       | Design Data              |             |                  |    |    |  |
| Eccentricity withi              | n mid     | dle third        |         | fb/FB + fa/Fa            | =           | 0.519            |    |    |  |
| Soil Pressure @ Loe             | =         | 1,094 p          | st OK   | Total Force @ Section    |             |                  |    |    |  |
|                                 | =         | 620 μ<br>4 000 m | ISI UK  | Service Level            | lbs =       |                  |    |    |  |
| Allowable<br>Soil Pressure Less | =<br>Than | 4,000 p          | ST      | Strength Level           | lbs =       | 1,480.0          |    |    |  |
| ACL Factored @ Toe              | =         | 1 531 n          | sf      | MomentActual             | <b>e</b> 11 |                  |    |    |  |
| ACI Factored @ Heel             | =         | 876 p            | sf      |                          | π-# =       | 2 2 4 5 2        |    |    |  |
| Footing Shear @ Toe             | =         | 15.1 n           | si OK   | Strength Level           | π-# =       | 3,345.3          |    |    |  |
| Footing Shear @ Heel            | =         | 4.3 n            | si OK   | MomentAllowable          | =           | 6,444.1          |    |    |  |
| Allowable                       | =         | 75.0 p           | si      | ShearActual              |             |                  |    |    |  |
|                                 |           |                  |         | Service Level            | psi =       |                  |    |    |  |
| Sliding Calcs                   |           |                  |         | Strength Level           | psi =       | 19.7             |    |    |  |
| Lateral Sliding Force           | =         | 1,217.3 lk       | os      | ShearAllowable           | psi =       | 75.0             |    |    |  |
| less 100% Passive Force         | ə -       | 266.7 lk         | os      | Anet (Masonry)           | in2 =       |                  |    |    |  |
| less 100% Friction Force        | := -      | 1,884.7 lk       | os      | Wall Weight              | psf =       | 100.0            |    |    |  |
| Added Force Req'd               | =         | 0.0 lt           | os OK   | Rebar Depth 'd'          | in =        | 6.25             |    |    |  |
| for 1.5 Stability               | =         | 0.0 ll           | bs OK   |                          |             |                  |    |    |  |
|                                 |           |                  |         | Masonry Data             |             |                  |    |    |  |
| Vertical component of active    | later     | al soll pres     | sure 15 | Fe                       | psi =       |                  |    |    |  |
| NOT considered in the calcu     | llation   |                  | anng    | Solid Grouting           | psi =       |                  |    |    |  |
| Load Factors                    |           |                  |         | Modular Batio 'n'        | =           |                  |    |    |  |
| Building Code                   |           |                  |         | Fouriv Solid Thick       | _           |                  |    |    |  |
| Dead Load                       |           | 1.200            | )       | Masonry Block Type       | _           |                  |    |    |  |
| Live Load                       |           | 1.600            | )       | Masonry Design Method    | =           | ASD              |    |    |  |
| Earth, H                        |           | 1.600            | )       | Concrete Data            |             |                  |    |    |  |
| Wind, W                         |           | 1.600            | )       | f'c                      | psi =       | 2,500.0          |    |    |  |
| Seismic, E                      |           | 1.000            | )       | Fy                       | psi =       | 60,000.0         |    |    |  |
|                                 |           |                  |         |                          |             |                  |    |    |  |

Printed: 19 SEP 2022, 5:59PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

**DESCRIPTION:** SE @ ADU/Laundry (12/S3.1)

#### **Concrete Stem Rebar Area Details**

| Bottom Stem                      | Vertical Reinforcing | Horizontal Reinforcing                                       |
|----------------------------------|----------------------|--|
| As (based on applied moment) :   | 0.1253 in2/ft        |  |
| (4/3) * As :                     | 0.1671 in2/ft        | Min Stem T&S Reinf Area 1.376 in2                            |
| 200bd/fy : 200(12)(6.25)/60000 : | 0.25 in2/ft          | Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft |
| 0.0018bh : 0.0018(12)(8) :       | 0.1728 in2/ft        | Horizontal Reinforcing Options :                             |
|                                  |                      | One layer of : Two layers of :                               |
| Required Area :                  | 0.1728 in2/ft        | #4@ 12.50 in #4@ 25.00 in                                    |
| Provided Area :                  | 0.24 in2/ft          | #5@ 19.38 in #5@ 38.75 in                                    |
| Maximum Area :                   | 0.8467 in2/ft        | #6@ 27.50 in #6@ 55.00 in                                    |
|                                  |                      |  |

#### **Footing Data**

| Toe Width           | =        | 2.00 ft       |
|---------------------|----------|---------------|
| Heel Width          | =        | 2.75          |
| Total Footing Width | =        | 4.75          |
| Footing Thickness   | =        | 12.00 in      |
| Key Width           | =        | 0.00 in       |
| Key Depth           | =        | 0.00 in       |
| Key Distance from T | oe =     | 0.00 ft       |
| f'c = 2,500 psi     | Fy =     | 60,000 psi    |
| Footing Concrete De | ensity = | 150.00 pcf    |
| Min. As %           | =        | 0.0000        |
| Cover @ Top 2       | .00 @    | Btm.= 3.00 in |

#### **Footing Design Results**

|                        |      | <u>Toe</u>     | <u>Heel</u> |    |
|------------------------|------|----------------|-------------|----|
| Factored Pressure      | =    | 1,531          | 876 psf     |    |
| Mu' : Upward           | =    | 2,879          | 2,110 ft-#  |    |
| Mu' : Downward         | =    | 464            | 2,730 ft-#  |    |
| Mu: Design             | =    | 2,415 OK       | 620 ft-#    | OK |
| phiMn                  | =    | 9,145          | 10,225 ft-# |    |
| Actual 1-Way Shear     | =    | 15.11          | 4.35 psi    |    |
| Allow 1-Way Shear      | =    | 75.00          | 75.00 psi   |    |
| Toe Reinforcing        | =    | # 4 @ 10.00 in |             |    |
| Heel Reinforcing       | =    | # 4 @ 10.00 in |             |    |
| Key Reinforcing        | =    | None Spec'd    |             |    |
| Footing Torsion, Tu    |      | =              | 0.00 ft-lbs |    |
| Footing Allow. Torsion | n, p | ohi Tu =       | 0.00 ft-lbs |    |

#### If torsion exceeds allowable, provide

supplemental design for footing torsion.

#### Other Acceptable Sizes & Spacings

Toe: #4@ 27.44 in, #5@ 42.53 in, #6@ 60.37 in, #7@ 82.32 in, #8@ 108.39 in, #9@ 137.20 in, #10@ 174.25 in

Heel: #4@ 119.89 in, #5@ 185.83 in, #6@ 263.76 in, #7@ 359.68 in, #8@ 473.58 in, #9@ 599.47 in, #10@ 761.33 in

Key: No key defined

| Min footing T&S reinf Area          | 1.23 in2                          |  |
|-------------------------------------|-----------------------------------|--|
| Min footing T&S reinf Area per foot | 0.26 in2 /ft                      |  |
| f one layer of horizontal bars:     | If two layers of horizontal bars: |  |
| #4@ 9.26 in                         | #4@ 18.52 in                      |  |
| #5@ 14.35 in                        | #5@ 28.70 in                      |  |
| #6@ 20.37 in                        | #6@ 40.74 in                      |  |
|                                     |                                   |  |

Printed: 19 SEP 2022, 5:59PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: SE @ ADU/Laundry (12/S3.1)

#### Summary of Overturning & Resisting Forces & Moments

| OVERTURNING                                    |       |              | RE             | RESISTING      |  |               |                 |                |
|--|-------|--------------|----------------|----------------|--|---------------|-----------------|----------------|
| Item   |       | Force<br>lbs | Distance<br>ft | Moment<br>ft-# |  | Force<br>Ibs  | Distance<br>ft  | Moment<br>ft-# |
| HL Act Pres (ab water th                       | d)    | 1,125.0      | 2.50           | 2,812.5        | Soil Over HL (ab. water tbl)                 | 1,760.4       | 3.71            | 6,528.2        |
| HL Act Pres (be water the<br>Hvdrostatic Force | l)    |              |                |                | Soil Over HL (bel. water tbl)<br>Watre Table |               | 3.71            | 6,528.2        |
| Buovant Force                                  | =     |              |                |                | Sloped Soil Over Heel =                      |               |                 |                |
| Surcharge over Heel                            | =     | 92.3         | 3 75           | 346.2          | Surcharge Over Heel =                        | 83.3          | 3.71            | 309.0          |
| Surcharge Over Toe                             | =     | 02.0         | 0.10           | 010.2          | Adjacent Footing Load =                      |               |                 |                |
| Adjacent Footing Load                          | =     |              |                |                | Axial Dead Load on Stem =                    | 290.0         | 2.33            | 676.7          |
| Added Lateral Load                             | =     |              |                |                | * Axial Live Load on Stem =                  | 435.0         | 2.33            | 1,015.0        |
| Load @ Stem Above So                           | il =  |              |                |                | Soil Over Toe =                              | 86.7          | 1.00            | 86.7           |
|  | =     |              |                |                | Surcharge Over Toe =                         |               |                 |                |
|  | _     |              |                |                | Stem Weight(s) =                             | 716.7         | 2.33            | 1,672.3        |
|  |       |              |                |                | Earth @ Stem Transitions =                   |               |                 |                |
| Total  | =     | 1,217.3      | O.T.M. =       | 3,158.7        | Footing Weight =                             | 712.5         | 2.38            | 1,692.2        |
|  |       |              |                |                | Key Weight =                                 |               |                 |                |
| Resisting/Overturnin                           | g Rat | io           | =              | 3.47           | Vert. Component =                            |               |                 |                |
| Vertical Loads used f                          | or So | Pressure     | = 4,084.       | 6 lbs          | Total =                                      | 3.649.6       | bs <b>R.M.=</b> | 10.965.1       |
|  |       |              |                |                | * Axial live load NOT included in            | total display | ed or used fo   | r overturning  |

Axial live load NOT included in total displayed, or used for overtu resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus250.0pciHorizontal Defl @ Top of Wall (approximate only)0.046in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe.

because the wall would then tend to rotate into the retained soil.

Printed: 19 SEP 2022, 5:59PM **Cantilevered Retaining Wall** Project File: Foundations.ec6 (c) ENERCALC INC 1983-2022 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN DESCRIPTION: SE @ ADU/Laundry (12/S3.1) **Rebar Lap & Embedment Lengths Information** Stem Design Segment: Bottom Stem Design Height: 0.00 ft above top of footing Lap Splice length for #4 bar specified in this stem design segment = 18.72 in Development length for #4 bar specified in this stem design segment = 14.40 in Hooked embedment length into footing for #4 bar specified in this stem design segment = 6.05 in 0.2400 in2/ft As Provided = As Required = 0.1728 in2/ft

Printed: 19 SEP 2022, 5:59PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |

DESCRIPTION: SE @ ADU/Laundry (12/S3.1)



Printed: 19 SEP 2022, 5:59PM



**DESCRIPTION:** SE @ ADU/Laundry (12/S3.1)


### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN DESCRIPTION: Garage wall at alley revised for shoring (11/S3.3)

#### Code Reference:

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

| Criteria  |                           |                              | Soil Data  |                    |  |   |             |  |
|---|---------------------------|------------------------------|--|--------------------|--|---|-------------|--|
| Retained Height<br>Wall height above soil<br>Slope Behind Wall                                | =<br>=<br>=               | 8.00 ft<br>1.00 ft<br>0.00   | Allow Soil Bearing<br>Equivalent Fluid Pressur<br>Active Heel Pressure   | =<br>re Metł<br>=  | 5,332.0 psf<br>nod<br>40.0 psf/ft                            |   |             |  |
| Height of Soil over Toe<br>Water height over heel   | =                         | 6.00 in<br>0.0 ft            | Passive Pressure<br>Soil Density, Heel<br>Soil Density, Toe<br>Footing  Soil Friction<br>Soil height to ignore<br>for passive pressure | =<br>=<br>=<br>=   | 300.0 psf/ft<br>130.00 pcf<br>130.00 pcf<br>0.450<br>0.00 in |   |             |  |
| Surcharge Loads   |                           |                              | Lateral Load Appl  | ied to             | o Stem   | Adjacent Footing  | Load        |  |
| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Ove | g & Ove<br>=<br>erturning | 0.0 psf<br>rturning<br>0.0   | Lateral Load<br>Height to Top<br>Height to Bottom  | =<br>=<br>=<br>= W | 0.0 #/ft<br>0.00 ft<br>0.00 ft<br>ind (W)                    | Adjacent Footing Load<br>Footing Width<br>Eccentricity<br>Wall to Ftg CL Dist | =<br>=<br>= | 0.0 lbs<br>0.00 ft<br>0.00 in<br>0.00 ft |
| Axial Load Applie   | d to S                    | tem                          |  | - VV<br>(S         | ervice Level)  | Footing Type  | S           | pread Footing                            |
| Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity                                 | =<br>=<br>=               | 0.0 lbs<br>0.0 lbs<br>0.0 in | Wind on Exposed Stem<br>(Strength Level)   | ) =                | 0.0 psf  | at Back of Wall<br>Poisson's Ratio  | =<br>=      | 0.0 ft<br>0.300                          |
| Earth Pressure S  | eismio                    | : Load                       |  |                    |  |   |             |  |
| Method : Triangular<br>Load at bottom of Trian<br>(Strength)                                  | gular Di                  | stribution                   | = 9.000 psf  | Total<br>Tota      | Strength-Level S<br>Service-Level Se                         | eismic Load<br>eismic Load  | =           | 40.500 lbs<br>28.350 lbs                 |

Printed: 19 SEP 2022, 3:15PM

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

Printed: 19 SEP 2022, 3:15PM

#### Cantilevered Retaining Wall LIC# : KW-06015393, Build:20.22.7.14

#### (c) ENERCALC INC 1983-2022

Project File: Foundations.ec6

LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN DESCRIPTION: Garage wall at alley revised for shoring (11/S3.3)

| Design Summary                                  | Stem Construction      | n _         | Bottom          |    |    |  |
|---|------------------------|-------------|-----------------|----|----|--|
|   | Design Height Abo      | ve Ftg ft = | Stem OK<br>0.00 |    |    |  |
| Wall Stability Ratios                           | Wall Material Abov     | /e "Ht" =   | Concrete        |    |    |  |
| Sliding $-$ 1.49 F                              | DK Design Method       | =           | SD              | SD | SD |  |
|   | Thickness              | =           | 8.00            |    |    |  |
| Global Stability = 1.64                         | Rebar Size             | =           | # 5             |    |    |  |
|   | Rebar Spacing          | =           | 12.00           |    |    |  |
| Total Bearing Load = 3,920 lb                   | os Rebar Placed at     | =           | Edge            |    |    |  |
| resultant ecc. = 12.68 ir                       |                        | _           | 0.682           |    |    |  |
| Eccentricity outside middle third               | sf OK Total Farag @ Sa | =<br>otion  | 0.002           |    |    |  |
| Soil Pressure @ Heel = 0 n                      |                        | cuon<br>lbo |                 |    |    |  |
| Allowable $=$ 5.332 p                           | sf Ctranath Lavel      | IDS =       | 0.000.0         |    |    |  |
| Soil Pressure Less Than Allowable               | Si Strength Level      | IDS =       | 2,080.0         |    |    |  |
| ACI Factored @ Toe = 4.715 p                    | sf Service Level       | f+ #        |                 |    |    |  |
| ACI Factored @ Heel = 0 p                       | sf Strongth Lovel      | 11-# =      | E E 4 C 7       |    |    |  |
| Footing Shear @ Toe = 0.1 p                     | si OK                  |             | 5,540.7         |    |    |  |
| Footing Shear @ Heel = 31.3 p                   | si OK                  | ble =       | 8,121.3         |    |    |  |
| Allowable = $75.0 \text{ p}$                    | si ShearActual         |             |                 |    |    |  |
| · ···· ·  | Service Level          | psi =       |                 |    |    |  |
| Sliding Calcs                                   | Strength Level         | psi =       | 28.0            |    |    |  |
| Lateral Sliding Force = 1,648.4 lb              | s ShearAllowable       | e psi =     | 75.0            |    |    |  |
| less 100% Passive Force - 337.5 lb              | Anet (Masonry)         | in2 =       |                 |    |    |  |
| less 100% Friction Force = - 2,113.0 lb         | s Wall Weight          | psf =       | 100.0           |    |    |  |
| Added Force Reg'd = 0.0 lb                      | os OK Rebar Depth 'd'  | in =        | 6.19            |    |    |  |
| for 1.5 Stability = 22.0 II                     | os NG                  |             |                 |    |    |  |
| ·   | Masonry Data           |             |                 |    |    |  |
| Vertical component of active lateral soil press | sure IS f'm            | psi =       |                 |    |    |  |
| NOT considered in the calculation of soil bea   | iring Fs               | psi =       |                 |    |    |  |
|   | Solid Grouting         | . =         |                 |    |    |  |
| Load Factors                                    | Modular Ratio 'n'      | =           |                 |    |    |  |
| Building Code                                   | Equiv. Solid Thick.    | =           |                 |    |    |  |
| Dead Load 1.200                                 | Masonry Block Typ      | e =         |                 |    |    |  |
| Live Load 1.600                                 | Masonry Design M       | ethod =     | ASD             |    |    |  |
| Earth, H 1.600                                  | Concrete Data          |             |                 |    |    |  |
| Wind, W 1.600                                   | f'c                    | psi =       | 2,500.0         |    |    |  |
| Seismic, E 1.000                                | P Fy                   | psi =       | 60,000.0        |    |    |  |

Printed: 19 SEP 2022, 3:15PM

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN DESCRIPTION: Garage wall at alley revised for shoring (11/S3.3)

#### **Concrete Stem Rebar Area Details**

| Bottom Stem                        | Vertical Reinforcing | Horizontal Reinforcing                                |  |  |  |
|------------------------------------|----------------------|---|--|--|--|
| As (based on applied moment) :     | 0.21 in2/ft          |   |  |  |  |
| (4/3) * As :                       | 0.28 in2/ft          | Min Stem T&S Reinf Area 1.728 in2                     |  |  |  |
| 200bd/fy : 200(12)(6.1875)/60000 : | 0.2475 in2/ft        | Min Stem T&S Reinf Area per ft of stem Height : 0.192 |  |  |  |
| 0.0018bh : 0.0018(12)(8) :         | 0.1728 in2/ft        | Horizontal Reinforcing Options :                      |  |  |  |
|                                    |                      | One layer of : Two layers of :                        |  |  |  |
| Required Area :                    | 0.2475 in2/ft        | #4@ 12.50 in #4@ 25.00 in                             |  |  |  |
| Provided Area :                    | 0.31 in2/ft          | #5@ 19.38 in #5@ 38.75 in                             |  |  |  |
| Maximum Area :                     | 0.8382 in2/ft        | #6@ 27.50 in #6@ 55.00 in                             |  |  |  |

#### **Footing Data**

| Toe Width             | =     | 0.    | 67 ft   |
|-----------------------|-------|-------|---------|
| Heel Width            | = _   | 3.    | 00      |
| Total Footing Width   | =     | 3.    | 67      |
| Footing Thickness     | =     | 12.   | 00 in   |
| Key Width             | =     | 0.    | 00 in   |
| Key Depth             | =     | 0.    | 00 in   |
| Key Distance from Toe | =     | 0.    | 00 ft   |
| f'c = 2,500 psi       | Fy =  | 60,0  | 00 psi  |
| Footing Concrete Dens | ity = | 150.  | 00 pcf  |
| Min. As %             | =     | 0.00  | 00      |
| Cover @ Top 2.00      | @ E   | 3tm.= | 3.00 in |

#### **Footing Design Results**

|                        |      | <u>Toe</u>     | <u>Heel</u> |    |
|------------------------|------|----------------|-------------|----|
| Factored Pressure      | =    | 4,715          | 0 psf       |    |
| Mu' : Upward           | =    | 946            | 333 ft-#    |    |
| Mu' : Downward         | =    | 57             | 6,783 ft-#  |    |
| Mu: Design             | =    | 889 OK         | 6,450 ft-#  | Ok |
| phiMn                  | =    | 7,663          | 10,225 ft-# |    |
| Actual 1-Way Shear     | =    | 0.12           | 31.32 psi   |    |
| Allow 1-Way Shear      | =    | 75.00          | 75.00 psi   |    |
| Toe Reinforcing        | =    | # 4 @ 12.00 in |             |    |
| Heel Reinforcing       | =    | # 4 @ 10.00 in |             |    |
| Key Reinforcing        | =    | None Spec'd    |             |    |
| Footing Torsion, Tu    |      | =              | 0.00 ft-lbs |    |
| Footing Allow. Torsion | n, p | ohi Tu =       | 0.00 ft-lbs |    |

#### If torsion exceeds allowable, provide

supplemental design for footing torsion.

#### Other Acceptable Sizes & Spacings

Toe: #4@ 74.56 in, #5@ 115.58 in, #6@ 164.05 in, #7@ 223.70 in, #8@ 294.54 in, #9@ 372.84 in, #10@ 473.51 in

Heel: #4@ 11.52 in, #5@ 17.87 in, #6@ 25.36 in, #7@ 34.58 in, #8@ 45.54 in, #9@ 57.64 in, #10@ 73.21 in

Key: No key defined

| Min footing T&S reinf Area          | 0.95        | in2                     |
|-------------------------------------|-------------|-------------------------|
| Min footing T&S reinf Area per foot | 0.26        | in2 /ft                 |
| f one layer of horizontal bars:     | If two laye | ers of horizontal bars: |
| #4@ 9.26 in                         | #4@ 1       | 8.52 in                 |
| #5@ 14.35 in                        | #5@ 2       | 8.70 in                 |
| #6@ 20.37 in                        | #6@ 4       | 0.74 in                 |
|                                     |             |                         |

(c) ENERCALC INC 1983-2022

Project File: Foundations.ec6

Printed: 19 SEP 2022, 3:15PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

(c) ENERCALC INC 1983-2022

LIC# : KW-06015393, Build:20.22.7.14 **DESCRIPTION:** Garage wall at alley revised for shoring (11/S3.3)

#### Summary of Overturning & Resisting Forces & Moments

|                           |        | OV           | ERTURNING      | )       |                              |         | RE             | SISTING         |                |
|---------------------------|--------|--------------|----------------|---------|------------------------------|---------|----------------|-----------------|----------------|
| Item                      |        | Force<br>lbs | Distance<br>ft | ft-#    |                              |         | Force<br>Ibs   | Distance<br>ft  | Moment<br>ft-# |
| HL Act Pres (ab water th  | ol)    | 1.620.0      | 3.00           | 4.860.0 | Soil Over HL (ab. water t    | tbl)    | 2,426.7        | 2.50            | 6,065.0        |
| HL Act Pres (be water th  | ol)    | ,            |                | ,       | Soil Over HL (bel. water     | tbl)    |                | 2.50            | 6,065.0        |
| Hydrostatic Force         |        |              |                |         |                              |         |                |                 |                |
| Buoyant Force             | =      |              |                |         | Sloped Soil Over Heel        | =       |                |                 |                |
| Surcharge over Heel       | =      |              |                |         | Surcharge Over Heel          | =       |                |                 |                |
| Surcharge Over Toe        | =      |              |                |         | Adjacent Footing Load        | =       |                |                 |                |
| Adjacent Footing Load     | =      |              |                |         | Axial Dead Load on Stem      | า =     |                |                 |                |
| Added Lateral Load        | =      |              |                |         | * Axial Live Load on Stem    | =       |                |                 |                |
| Load @ Stem Above So      | oil =  |              |                |         | Soil Over Toe                | =       | 43.3           | 0.33            | 14.4           |
| Seismic Farth Load        | _      | 28.4         | 3 00           | 85.1    | Surcharge Over Toe           | =       |                |                 |                |
| Celonito Editin Edita     | _      | 20.4         | 0.00           | 00.1    | Stem Weight(s)               | =       | 900.0          | 1.00            | 899.4          |
|                           |        |              |                |         | Earth @ Stem Transitions     | s =     |                |                 |                |
| Total                     | =      | 1,648.4      | O.T.M. =       | 4,945.1 | Footing Weight               | =       | 549.9          | 1.83            | 1,008.0        |
|                           |        |              |                |         | Key Weight                   | =       |                |                 |                |
| Resisting/Overturnin      | ig Rat | io           | =              | 2.19    | Vert. Component              | =       | 775.7          | 3.67            | 2,843.6        |
| Vertical Loads used       | for So | il Pressure  | = 3,919.       | 9 lbs   | Tota                         | l =     | 4,695.5        | os <b>R.M.=</b> | 10,830.4       |
|                           |        |              |                |         | * Axial live load NOT includ | ded in  | total displaye | ed, or used fo  | r overturning  |
| If seismic is included th | he OT  | M and slidin | na ratios      |         | resistance, but is included  | d for s | oil pressure o | calculation.    | 0              |

BYKONEN CARTER QUINN

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.230 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Printed: 19 SEP 2022, 3:15PM **Cantilevered Retaining Wall** Project File: Foundations.ec6 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022 **DESCRIPTION:** Garage wall at alley revised for shoring (11/S3.3) **Rebar Lap & Embedment Lengths Information** Stem Design Segment: Bottom Stem Design Height: 0.00 ft above top of footing Lap Splice length for #5 bar specified in this stem design segment = 23.40 in Development length for #5 bar specified in this stem design segment = 18.00 in Hooked embedment length into footing for #5 bar specified in this stem design segment = 8.38 in As Provided = 0.3100 in2/ft As Required = 0.2475 in2/ft

Printed: 19 SEP 2022, 3:15PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |
|                                      |                      |                               |

**DESCRIPTION:** Garage wall at alley revised for shoring (11/S3.3)



Printed: 19 SEP 2022, 3:15PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |

**DESCRIPTION:** Garage wall at alley revised for shoring (11/S3.3)



#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN DESCRIPTION: Garage wall at alley revised for shoring (11/S3.3)

#### Code Reference:

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

8.00 ft

1.00 ft

6.00 in

0.0 ft

0.00

=

=

=

#### Criteria

**Retained Height** 

Slope Behind Wall

Wall height above soil

Height of Soil over Toe =

Water height over heel =

#### Soil Data

| Allow Soil Bearing                            | =<br>Meth | 4,000.0 | psf    |
|---|-----------|---------|--------|
| Active Heel Pressure                          | =         | 40.0    | psf/f  |
|   | =         |         |        |
| Passive Pressure                              | =         | 300.0   | psf/ft |
| Soil Density, Heel                            | =         | 130.00  | pcf    |
| Soil Density, Toe                             | =         | 130.00  | pcf    |
| Footing  Soil Friction                        | =         | 0.450   |        |
| Soil height to ignore<br>for passive pressure | =         | 0.00    | in     |

#### Lateral Load Applied to Stem

| Lateral Load<br>Height to Top<br>Height to Bottom | =<br>=<br>= | 0.0 #/ft<br>0.00 ft<br>0.00 ft |
|---|-------------|--------------------------------|
| Load Type   | =           | Wind (W)<br>(Service Level)    |
| Wind on Exposed Stem (Strength Level)             | =           | 0.0 psf                        |

#### **Adjacent Footing Load**

| Adjacent Footing Load                    | = | 0.0 lbs        |
|--|---|----------------|
| Footing Width                            | = | 0.00 ft        |
| Eccentricity                             | = | 0.00 in        |
| Wall to Ftg CL Dist                      | = | 0.00 ft        |
| Footing Type                             |   | Spread Footing |
| Base Above/Below Soil<br>at Back of Wall | = | 0.0 ft         |
|  |   |                |

#### Surcharge Loads

| Surcharge Over Hee         | =          | 0.0 psf   |  |  |  |
|----------------------------|------------|-----------|--|--|--|
| Used To Resist Slid        | ling & Ov  | erturning |  |  |  |
| Surcharge Over Toe         | =          | 0.0       |  |  |  |
| Used for Sliding & C       | Overturnir | ng        |  |  |  |
| Axial Load Applied to Stem |            |           |  |  |  |
| Axial Dead Load            | =          | 0.0 lbs   |  |  |  |

| Axial Live Load         | = | 0.0 lbs |
|-------------------------|---|---------|
| Axial Load Eccentricity | = | 0.0 in  |

Printed: 19 SEP 2022, 3:14PM

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

Printed: 19 SEP 2022, 3:14PM

#### Cantilevered Retaining Wall LIC# : KW-06015393, Build:20.22.7.14

#### (c) ENERCALC INC 1983-2022

Project File: Foundations.ec6

LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN DESCRIPTION: Garage wall at alley revised for shoring (11/S3.3)

| Design Summary                  |           |                        | Stem Construction        |            | Bottom   |    |    |  |
|---------------------------------|-----------|------------------------|--------------------------|------------|----------|----|----|--|
|                                 |           |                        | Design Height Above Ftg  |            | Stem OK  |    |    |  |
| Wall Stability Ratios           |           |                        | Wall Material Above "Ht" |            | Concrete |    |    |  |
| Overturning                     | =         | 2.23 OK                | Design Method            | _          | SD       | SD | SD |  |
| Sliding                         | =         | 1.51 OK                | Thickness                | =          | 8.00     | 00 | 00 |  |
| Global Stability                | =         | 1.64                   | Rebar Size               | =          | # 5      |    |    |  |
|                                 |           |                        | Rebar Spacing            | =          | 12.00    |    |    |  |
| Total Bearing Load              | =         | 3.920 lbs              | Rebar Placed at          | =          | Edge     |    |    |  |
| resultant ecc.                  | =         | 12.42 in               | Design Data              |            |          |    |    |  |
| Eccentricity outsid             | de mio    | ddle third             | fb/FB + fa/Fa            | =          | 0.672    |    |    |  |
| Soil Pressure @ Toe             | =         | 3,276 psf OK           | Total Force @ Section    |            |          |    |    |  |
| Soli Pressure @ Heel            | =         |                        | Service Level            | lbs =      |          |    |    |  |
| Allowable<br>Soil Prossure Loss | =<br>Thon | 4,000 pst              | Strength Level           | lbs =      | 2,048.0  |    |    |  |
| ACI Eactored @ Toe              |           | Allowable<br>4 586 pef | MomentActual             |            |          |    |    |  |
| ACI Factored @ Heel             | _         | 4,500 psi<br>0 psf     | Service Level            | ft-# =     |          |    |    |  |
| Footing Shoar @ Too             | _         |                        | Strength Level           | ft-# =     | 5,461.3  |    |    |  |
| Footing Shear @ Heel            | =         | 20.7 poi OK            | MomentAllowable          | =          | 8,121.3  |    |    |  |
| Allowable                       | =         | 30.7 psi OK            | ShearActual              |            |          |    |    |  |
| Allowable                       | -         | 75.0 psi               | Service Level            | psi =      |          |    |    |  |
| Sliding Calcs                   |           |                        | Strength Level           | psi =      | 27.6     |    |    |  |
| Lateral Sliding Force           | _         | 1.620.0 lbs            | ShearAllowable           | ,<br>psi = | 75.0     |    |    |  |
| less 100% Passive Force         |           | 337.5 lbs              | Anet (Masonry)           | in2 =      |          |    |    |  |
| less 100% Friction Force        | : ≡ -     | 2,113.0 lbs            | Wall Weight              | psf =      | 100.0    |    |    |  |
| Added Force Reg'd               | =         | 0.0 lbs OK             | Rebar Depth 'd'          | in =       | 6.19     |    |    |  |
| for 1.5 Stability               | =         | 0.0 lbs OK             |                          |            | 0.10     |    |    |  |
|                                 |           |                        | Masonry Data             |            |          |    |    |  |
| Vertical component of active    | e later   | al soil pressure IS    | f'm                      | psi =      |          |    |    |  |
| NOT considered in the calcu     | ulation   | of soil bearing        | Fs                       | psi =      |          |    |    |  |
|                                 |           |                        | Solid Grouting           | =          |          |    |    |  |
| Load Factors                    |           |                        | Modular Ratio 'n'        | =          |          |    |    |  |
| Building Code                   |           | 4 000                  | Equiv. Solid Thick.      | =          |          |    |    |  |
|                                 |           | 1.200                  | Masonry Block Type       | =          |          |    |    |  |
|                                 |           | 1.000                  | Masonry Design Method    | =          | ASD      |    |    |  |
|                                 |           | 1.600                  | Concrete Data            |            |          |    |    |  |
| vvina, vv                       |           | 1.600                  | ťc                       | psi =      | 2,500.0  |    |    |  |
| Seismic, E                      |           | 1.000                  | гy                       | psi =      | 60,000.0 |    |    |  |

Printed: 19 SEP 2022, 3:14PM

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN DESCRIPTION: Garage wall at alley revised for shoring (11/S3.3)

#### **Concrete Stem Rebar Area Details**

| Bottom Stem                        | Vertical Reinforcing | Horizontal Reinforcing                                       |
|------------------------------------|----------------------|--|
| As (based on applied moment) :     | 0.2068 in2/ft        |  |
| (4/3) * As :                       | 0.2757 in2/ft        | Min Stem T&S Reinf Area 1.728 in2                            |
| 200bd/fy : 200(12)(6.1875)/60000 : | 0.2475 in2/ft        | Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft |
| 0.0018bh : 0.0018(12)(8) :         | 0.1728 in2/ft        | Horizontal Reinforcing Options :                             |
|                                    |                      | One layer of : Two layers of :                               |
| Required Area :                    | 0.2475 in2/ft        | #4@ 12.50 in #4@ 25.00 in                                    |
| Provided Area :                    | 0.31 in2/ft          | #5@ 19.38 in #5@ 38.75 in                                    |
| Maximum Area :                     | 0.8382 in2/ft        | #6@ 27.50 in #6@ 55.00 in                                    |

#### **Footing Data**

| Toe Width             | = 0.67 ft         |
|-----------------------|-------------------|
| Heel Width            | = 3.00            |
| Total Footing Width   | = 3.67            |
| Footing Thickness     | = 12.00 in        |
| Key Width             | = 0.00 in         |
| Key Depth             | = 0.00 in         |
| Key Distance from Toe | e = 0.00 ft       |
| f'c = 2,500 psi       | Fy = 60,000 psi   |
| Footing Concrete Dens | sity = 150.00 pcf |
| Min. As %             | = 0.0000          |
| Cover @ Top 2.00      | ) @ Btm.= 3.00 in |

#### **Footing Design Results**

|                        |      | <u>Toe</u>     | <u>Heel</u> |    |
|------------------------|------|----------------|-------------|----|
| Factored Pressure      | =    | 4,586          | 0 psf       |    |
| Mu' : Upward           | =    | 923            | 381 ft-#    |    |
| Mu' : Downward         | =    | 57             | 6,783 ft-#  |    |
| Mu: Design             | =    | 866 OK         | 6,402 ft-#  | OK |
| phiMn                  | =    | 7,663          | 10,225 ft-# |    |
| Actual 1-Way Shear     | =    | 0.12           | 30.66 psi   |    |
| Allow 1-Way Shear      | =    | 75.00          | 75.00 psi   |    |
| Toe Reinforcing        | =    | # 4 @ 12.00 in |             |    |
| Heel Reinforcing       | =    | # 4 @ 10.00 in |             |    |
| Key Reinforcing        | =    | None Spec'd    |             |    |
| Footing Torsion, Tu    |      | =              | 0.00 ft-lbs |    |
| Footing Allow. Torsion | n, p | ohi Tu =       | 0.00 ft-lbs |    |

#### If torsion exceeds allowable, provide

supplemental design for footing torsion.

#### Other Acceptable Sizes & Spacings

Toe: #4@ 76.55 in, #5@ 118.66 in, #6@ 168.42 in, #7@ 229.67 in, #8@ 302.40 in, #9@ 382.79 in, #10@ 486.14 in

Heel: #4@ 11.61 in, #5@ 18.00 in, #6@ 25.55 in, #7@ 34.84 in, #8@ 45.88 in, #9@ 58.07 in, #10@ 73.76 in

Key: No key defined

| Min footing T&S reinf Area          | 0.95       | in2                     |
|-------------------------------------|------------|-------------------------|
| Min footing T&S reinf Area per foot | 0.26       | in2 /ft                 |
| If one layer of horizontal bars:    | If two lay | ers of horizontal bars: |
| #4@ 9.26 in                         | #4@ 1      | 8.52 in                 |
| #5@ 14.35 in                        | #5@ 2      | 8.70 in                 |
| #6@ 20.37 in                        | #6@ 4      | 0.74 in                 |
|                                     |            |                         |

(c) ENERCALC INC 1983-2022

Project File: Foundations.ec6

Printed: 19 SEP 2022, 3:14PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

(c) ENERCALC INC 1983-2022

**DESCRIPTION:** Garage wall at alley revised for shoring (11/S3.3)

#### Summary of Overturning & Resisting Forces & Moments

|  |        | OV           | ERTURNING      |                |  | R            | ESISTING       |                |
|--|--------|--------------|----------------|----------------|--|--------------|----------------|----------------|
| Item                                       |        | Force<br>lbs | Distance<br>ft | Moment<br>ft-# |  | Force<br>lbs | Distance<br>ft | Moment<br>ft-# |
| HL Act Pres (ab water tb                   | I)     | 1,620.0      | 3.00           | 4,860.0        | Soil Over HL (ab. water tbl)                 | 2,426.7      | 2.50           | 6,065.0        |
| HL Act Pres (be water tb Hydrostatic Force | í)     |              |                | ·              | Soil Over HL (bel. water tbl)<br>Watre Table |              | 2.50           | 6,065.0        |
| Buoyant Force                              | =      |              |                |                | Sloped Soil Over Heel =                      |              |                |                |
| Surcharge over Heel                        | =      |              |                |                | Surcharge Over Heel =                        |              |                |                |
| Surcharge Over Toe                         | =      |              |                |                | Adjacent Footing Load =                      |              |                |                |
| Adjacent Footing Load                      | =      |              |                |                | Axial Dead Load on Stem =                    |              |                |                |
| Added Lateral Load                         | =      |              |                |                | * Axial Live Load on Stem =                  |              |                |                |
| Load @ Stem Above Soi                      | I =    |              |                |                | Soil Over Toe =                              | 43.3         | 0.33           | 14.4           |
|  | _      |              |                |                | Surcharge Over Toe =                         |              |                |                |
|  | -      |              |                |                | Stem Weight(s) =                             | 900.0        | 1.00           | 899.4          |
|  |        |              |                |                | Earth @ Stem Transitions =                   |              |                |                |
| Total                                      | =      | 1,620.0      | O.T.M. =       | 4,860.0        | Footing Weight =                             | 549.9        | 1.83           | 1,008.0        |
|  |        |              |                |                | Key Weight =                                 |              |                |                |
| Resisting/Overturning                      | g Rati | io           | =              | 2.23           | Vert. Component =                            | 775.7        | 3.67           | 2,843.6        |
| Vertical Loads used f                      | or Soi | I Pressure   | = 3,919.9      | 9 lbs          | Total =                                      | 4,695.5      | lbs R.M.=      | 10,830.4       |

BYKONEN CARTER QUINN

Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus250.0pciHorizontal Defl @ Top of Wall (approximate only)0.223in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Printed: 19 SEP 2022, 3:14PM **Cantilevered Retaining Wall** Project File: Foundations.ec6 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022 **DESCRIPTION:** Garage wall at alley revised for shoring (11/S3.3) **Rebar Lap & Embedment Lengths Information** Stem Design Segment: Bottom Stem Design Height: 0.00 ft above top of footing Lap Splice length for #5 bar specified in this stem design segment = 23.40 in Development length for #5 bar specified in this stem design segment = 18.00 in Hooked embedment length into footing for #5 bar specified in this stem design segment = 8.38 in As Provided = 0.3100 in2/ft As Required = 0.2475 in2/ft

Printed: 19 SEP 2022, 3:14PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |
|                                      |                      |                               |

**DESCRIPTION:** Garage wall at alley revised for shoring (11/S3.3)



Printed: 19 SEP 2022, 3:14PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |

**DESCRIPTION:** Garage wall at alley revised for shoring (11/S3.3)



#### Printed: 19 SEP 2022, 5:48PM

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 DESCRIPTION: SE @ Ext wall (11/S3.1)

#### Code Reference:

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

#### Criteria

| Soil | Data |
|------|------|
|      |      |

| = | 14.00 ft         |
|---|------------------|
| = | 1.00 ft          |
| = | 0.00             |
| = | 0.00 in          |
| = | 0.0 ft           |
|   | =<br>=<br>=<br>= |

#### Surcharge Loads

| Surcharge Over Heel = 0.0 psf<br>Used To Resist Sliding & Overturning<br>Surcharge Over Toe = 0.0<br>Used for Sliding & Overturning |   |                              |  |  |  |  |  |
|---|---|------------------------------|--|--|--|--|--|
| Axial Load Applied to Stem  |   |                              |  |  |  |  |  |
| Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity   | = | 0.0 lbs<br>0.0 lbs<br>0.0 in |  |  |  |  |  |

#### **Earth Pressure Seismic Load**

Method : Uniform Multiplier Used 9.000 = (Multiplier used on soil density)

| Allow Soil Bearing<br>Equivalent Fluid Pressure | =<br>Meth | 5,332.0<br>od | psf    |
|---|-----------|---------------|--------|
| Active Heel Pressure                            | =         | 40.0          | psf/ft |
|   | =         |               |        |
| Passive Pressure                                | =         | 300.0         | psf/ft |
| Soil Density, Heel                              | =         | 130.00        | pcf    |
| Soil Density, Toe                               | =         | 130.00        | pcf    |
| Footing  Soil Friction                          | =         | 0.450         |        |
| Soil height to ignore<br>for passive pressure   | =         | 0.00          | in     |

BYKONEN CARTER QUINN

#### Lateral Load Applied to Stem

| Lateral Load<br>Height to Top<br>Height to Bottom | =<br>=<br>=    | 0.0 #/ft<br>0.00 ft<br>0.00 ft |
|---|----------------|--------------------------------|
| Load Type   | =              | Wind (W)<br>(Service Level)    |
| Wind on Exposed Sten<br>(Strength Level)          | י <del>–</del> | 0.0 psf                        |

#### **Adjacent Footing Load**

| Adjacent Footing Load                    | = | 0.0 lbs        |
|--|---|----------------|
| Footing Width                            | = | 0.00 ft        |
| Eccentricity                             | = | 0.00 in        |
| Wall to Ftg CL Dist                      | = | 0.00 ft        |
| Footing Type                             |   | Spread Footing |
| Base Above/Below Soil<br>at Back of Wall | = | 0.0 ft         |
| Poisson's Ratio                          | _ | 0 300          |

#### Uniform Seismic Force = 139.500 Total Seismic Force = 2,162.250

Printed: 19 SEP 2022, 5:48PM

Project File: Foundations.ec6

#### Cantilevered Retaining Wall LIC# : KW-06015393, Build:20.22.7.14

#### BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: SE @ Ext wall (11/S3.1)

| Design Summary                |         | :                     | Stem Construction        | _         | Bottom          |    |    |  |
|-------------------------------|---------|-----------------------|--------------------------|-----------|-----------------|----|----|--|
|                               |         |                       | Design Height Above Ftg  | ft =      | Stem OK<br>0.00 |    |    |  |
| Wall Stability Ratios         |         |                       | Wall Material Above "Ht" | =         | Concrete        |    |    |  |
| Overturning                   | =       | 2.34 OK               | Design Method            | =         | SD              | SD | SD |  |
| Sliding                       | =       | 1.22 Ratio < 1.       | <sup>5!</sup> Thickness  | =         | 12.00           |    |    |  |
| Global Stability              | =       | 1.57                  | Rebar Size               | =         | # 7             |    |    |  |
| 2                             |         |                       | Rebar Spacing            | =         | 6.00            |    |    |  |
| Total Bearing Load            | =       | 16.398 lbs            | Rebar Placed at          | =         | Edge            |    |    |  |
| resultant ecc.                | =       | 7.43 in               | Design Data              |           |                 |    |    |  |
| Eccentricity withi            | n mic   | dle third             | fb/FB + fa/Fa            | =         | 0.976           |    |    |  |
| Soil Pressure @ Toe           | =       | 2,512 psf_OK          | Total Force @ Section    |           |                 |    |    |  |
| Soil Pressure @ Heel          | =       | 941 pst OK            | Service Level            | lbs =     |                 |    |    |  |
| Allowable                     | =       | 5,332 psf             | Strength Level           | lbs =     | 8,225.0         |    |    |  |
| Soil Pressure Less            | Thar    | Allowable             | MomentActual             |           |                 |    |    |  |
| ACI Factored @ Loe            | =       | 3,516 pst             | Service Level            | ft-# =    |                 |    |    |  |
|                               | =       |                       | Strength Level           | ft-# =    | 42,940.3        |    |    |  |
| Footing Shear @ Toe           | =       | 8.4 psi OK            | MomentAllowable          | =         | 43,991.1        |    |    |  |
| Footing Shear @ Heel          | =       | 31.5 psi OK           | ShearActual              |           |                 |    |    |  |
| Allowable                     | =       | 75.0 psi              | Service Level            | nsi =     |                 |    |    |  |
|                               |         |                       | Strength Level           | poi -     | 71 7            |    |    |  |
| Sliding Calcs                 |         |                       | Chaor Allowable          | psi =     | 71.7            |    |    |  |
| Lateral Sliding Force         | =       | 6,318.6 lbs           | SnearAllowable           | psi=      | 75.0            |    |    |  |
| less 100% Passive Force       | ə -     | 337.5 lbs             | Anet (Masonry)           | $\ln 2 =$ |                 |    |    |  |
| less 100% Friction Force      | :≡ -    | 7,379.2 lbs           | Wall Weight              | psf =     | 150.0           |    |    |  |
| Added Force Req'd             | =       | 0.0 lbs OK            | Rebar Depth 'd'          | in =      | 9.56            |    |    |  |
| for 1.5 Stability             | =       | 1,761.2 lbs NG        | Manager Data             |           |                 |    |    |  |
|                               |         |                       | Masonry Data             |           |                 |    |    |  |
| vertical component of active  | e later | ral soll pressure 15  |                          | psi =     |                 |    |    |  |
| considered in the calculation | 1 OF SC | bil bearing pressures | . FS<br>Solid Crouting   | psi =     |                 |    |    |  |
| Load Easters                  |         |                       |                          | =         |                 |    |    |  |
| Building Code                 |         |                       | Modular Ratio n          | =         |                 |    |    |  |
| Dead Load                     |         | 1 200                 | Equiv. Solid Thick.      | =         |                 |    |    |  |
| Live Load                     |         | 1.600                 |                          | =         |                 |    |    |  |
| Farth H                       |         | 1 600                 | Iviasonry Design Method  | =         | ASD             |    |    |  |
| Wind W                        |         | 1.600                 | Concrete Data            | nci -     | 2 500 0         |    |    |  |
| Seismic E                     |         | 1.000                 | FV                       | psi =     | 2,000.0         |    |    |  |
| Colornio, E                   |         | 1.000                 | i y                      | hei =     | 00,000.0        |    |    |  |

Printed: 19 SEP 2022, 5:48PM

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

DESCRIPTION: SE @ Ext wall (11/S3.1)

#### **Concrete Stem Rebar Area Details**

| Bottom Stem                        | Vertical Reinforcing | Horizontal Reinforcing                                       |
|------------------------------------|----------------------|--|
| As (based on applied moment) :     | 1.0323 in2/ft        |  |
| (4/3) * As :                       | 1.3764 in2/ft        | Min Stem T&S Reinf Area 4.320 in2                            |
| 200bd/fy : 200(12)(9.5625)/60000 : | 0.3825 in2/ft        | Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft |
| 0.0018bh : 0.0018(12)(12) :        | 0.2592 in2/ft        | Horizontal Reinforcing Options :                             |
|                                    |                      | One layer of : Two layers of :                               |
| Required Area :                    | 1.0323 in2/ft        | #4@ 8.33 in #4@ 16.67 in                                     |
| Provided Area :                    | 1.2 in2/ft           | #5@ 12.92 in #5@ 25.83 in                                    |
| Maximum Area :                     | 1.2954 in2/ft        | #6@ 18.33 in #6@ 36.67 in                                    |

#### **Footing Data**

| Toe Width             | =     | 1.    | 67 ft   |
|-----------------------|-------|-------|---------|
| Heel Width            | =     | 6.    | .50     |
| Total Footing Width   | =     | 8.    | .17     |
| Footing Thickness     | =     | 18.   | 00 in   |
| Key Width             | =     | 0.    | 00 in   |
| Key Depth             | =     | 0.    | 00 in   |
| Key Distance from Toe | =     | 0.    | 00 ft   |
| f'c = 2,500 psi       | Fy =  | 60,0  | 00 psi  |
| Footing Concrete Dens | ity = | 150.  | .00 pcf |
| Min. As %             | =     | 0.00  | 00      |
| Cover @ Top 2.00      | @ E   | 3tm.= | 3.00 in |

#### **Footing Design Results**

BYKONEN CARTER QUINN

|                        |      | <u>Toe</u>    | <u>Heel</u> |    |
|------------------------|------|---------------|-------------|----|
| Factored Pressure      | =    | 3,516         | 1,317 psf   |    |
| Mu' : Upward           | =    | 4,678         | 27,388 ft-# |    |
| Mu' : Downward         | =    | 375           | 57,362 ft-# |    |
| Mu: Design             | =    | 4,302 OK      | 29,975 ft-# | OK |
| phiMn                  | =    | 53,815        | 39,347 ft-# |    |
| Actual 1-Way Shear     | =    | 8.39          | 31.51 psi   |    |
| Allow 1-Way Shear      | =    | 75.00         | 75.00 psi   |    |
| Toe Reinforcing        | =    | # 6 @ 6.00 in |             |    |
| Heel Reinforcing       | =    | # 6 @ 9.02 in |             |    |
| Key Reinforcing        | =    | None Spec'd   |             |    |
| Footing Torsion, Tu    |      | =             | 0.00 ft-lbs |    |
| Footing Allow. Torsion | n, p | ohi Tu =      | 0.00 ft-lbs |    |

#### If torsion exceeds allowable, provide

supplemental design for footing torsion.

#### Other Acceptable Sizes & Spacings

Toe: #4@ 26.69 in, #5@ 41.38 in, #6@ 58.73 in, #7@ 80.09 in, #8@ 105.45 in, #9@ 133.49 in, #10@ 169.53 in

Heel: #4@ 4.10 in, #5@ 6.35 in, #6@ 9.02 in, #7@ 12.30 in, #8@ 16.20 in, #9@ 20.51 in, #10@ 26.05 in

Key: No key defined

| Min footing T&S reinf Area          | 3.18 in2                          |
|-------------------------------------|-----------------------------------|
| Vin footing T&S reinf Area per foot | 0.39 in2 /ft                      |
| f one layer of horizontal bars:     | If two layers of horizontal bars: |
| #4@ 6.17 in                         | #4@ 12.35 in                      |
| #5@ 9.57 in                         | #5@ 19.14 in                      |
| #6@ 13.58 in                        | #6@ 27.16 in                      |
|                                     |                                   |

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

Printed: 19 SEP 2022, 5:48PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

#### BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

#### DESCRIPTION: SE @ Ext wall (11/S3.1)

#### Summary of Overturning & Resisting Forces & Moments

|                            |        | ov           | ERTURNING      |                |  |                   | RE             | SISTING                        |                |
|----------------------------|--------|--------------|----------------|----------------|--|-------------------|----------------|--------------------------------|----------------|
| Item                       |        | Force<br>lbs | Distance<br>ft | Moment<br>ft-# |  |                   | Force<br>lbs   | Distance<br>ft                 | Moment<br>ft-# |
| HL Act Pres (ab water th   | ol)    | 4.805.0      | 5.17           | 24.825.8       | Soil Over HL (ab. water t                                  | tbl)              | 10,010.0       | 5.42                           | 54,224.2       |
| HL Act Pres (be water th   | )      | ,            | -              | ,              | Soil Over HL (bel. water                                   | tbl)              |                | 5.42                           | 54,224.2       |
| Hydrostatic Force          | ,      |              |                |                | Watre Table  |                   |                |                                |                |
| Buoyant Force              | =      |              |                |                | Sloped Soil Over Heel                                      | =                 |                |                                |                |
| Surcharge over Heel        | =      |              |                |                | Surcharge Over Heel  | =                 |                |                                |                |
| Surcharge Over Toe         | =      |              |                |                | Adjacent Footing Load                                      | =                 |                |                                |                |
| Adjacent Footing Load      | =      |              |                |                | Axial Dead Load on Sten                                    | n =               |                |                                |                |
| Added Lateral Load         | =      |              |                |                | * Axial Live Load on Stem                                  | =                 |                |                                |                |
| Load @ Stem Above So       | il =   |              |                |                | Soil Over Toe  | =                 |                |                                |                |
| Seismic Earth Load         | =      | 1,513.6      | 7.75           | 11,730.2       | Surcharge Over Toe   | =                 |                |                                |                |
|                            | =      |              |                |                | Stem Weight(s)   | =                 | 2,250.0        | 2.17                           | 4,875.8        |
|                            |        |              |                |                | Earth @ Stem Transition                                    | s=                |                |                                |                |
| lotal                      | =      | 6,318.6      | 0.1.M. =       | 36,556.0       | Footing Weight   | =                 | 1,837.6        | 4.08                           | 7,503.7        |
|                            |        |              |                |                | Key Weight   | =                 |                |                                |                |
| Resisting/Overturnin       | g Rat  | tio          | =              | 2.34           | Vert. Component  | =                 | 2,300.6        | 8.17                           | 18,789.4       |
| Vertical Loads used f      | for So | il Pressure  | = 16,398.3     | 2 lbs          | Tota   | al =              | 16,398.2 lt    | os <b>R.M.=</b>                | 85,393.0       |
| If seismic is included, th | ie OT  | M and slidin | g ratios       |                | * Axial live load NOT inclue<br>resistance, but is include | ded in<br>d for s | total displaye | ed, or used fo<br>calculation. | r overturning  |

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.128 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Printed: 19 SEP 2022, 5:48PM **Cantilevered Retaining Wall** Project File: Foundations.ec6 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022 DESCRIPTION: SE @ Ext wall (11/S3.1) **Rebar Lap & Embedment Lengths Information** Stem Design Segment: Bottom Stem Design Height: 0.00 ft above top of footing Lap Splice length for #7 bar specified in this stem design segment = 40.95 in Development length for #7 bar specified in this stem design segment = 31.50 in Hooked embedment length into footing for #7 bar specified in this stem design segment = 12.65 in As Provided = 1.2000 in2/ft As Required = 1.0323 in2/ft

Printed: 19 SEP 2022, 5:48PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |
|                                      |                      |                               |

DESCRIPTION: SE @ Ext wall (11/S3.1)



6'-6"

8'-2"

1'-8"

#6@9.02" @ Heel

3"

Printed: 19 SEP 2022, 5:48PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |

DESCRIPTION: SE @ Ext wall (11/S3.1)



#### Printed: 19 SEP 2022, 5:49PM

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 DESCRIPTION: SE @ Ext wall (11/S3.1)

#### Code Reference

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

#### Criteria

#### Soil Data

| Retained Height         | = | 14.00 ft |
|-------------------------|---|----------|
| Wall height above soil  | = | 1.00 ft  |
| Slope Behind Wall       | = | 0.00     |
| Height of Soil over Toe | = | 0.00 in  |
| Water height over heel  | = | 0.0 ft   |

#### Surcharge Loads

| Surcharge Over Heel<br>Used To Resist Slidi<br>Surcharge Over Toe<br>Used for Sliding & O | ng & Ov<br>=<br>verturnir | 0.0 psf<br>rerturning<br>0.0<br>ng |  |  |  |  |
|---|---------------------------|------------------------------------|--|--|--|--|
| Axial Load Applied to Stem  |                           |                                    |  |  |  |  |
| Axial Dead Load   | =                         | 0.0 lbs                            |  |  |  |  |

| Axial Live Load         | = | 0.0 lbs |
|-------------------------|---|---------|
| Axial Load Eccentricity | = | 0.0 in  |

| Allow Soil Bearing<br>Equivalent Fluid Pressure | =<br>Meth | 4,000.0<br>od | psf    |
|---|-----------|---------------|--------|
| Active Heel Pressure                            | =         | 40.0          | psf/ft |
|   | =         |               |        |
| Passive Pressure                                | =         | 300.0         | psf/ft |
| Soil Density, Heel                              | =         | 130.00        | pcf    |
| Soil Density, Toe                               | =         | 130.00        | pcf    |
| Footing  Soil Friction                          | =         | 0.450         |        |
| Soil height to ignore<br>for passive pressure   | =         | 0.00          | in     |

BYKONEN CARTER QUINN

#### Lateral Load Applied to Stem

| Lateral Load<br>Height to Top<br>Height to Bottom | =<br>=<br>= | 0.0 #/ft<br>0.00 ft<br>0.00 ft |
|---|-------------|--------------------------------|
| Load Type   | =           | Wind (W)<br>(Service Level)    |
| Wind on Exposed Ster<br>(Strength Level)          | m =         | 0.0 psf                        |

#### **Adjacent Footing Load**

| Adjacent Footing Load | = | 0.0 lbs        |
|-----------------------|---|----------------|
| Footing Width         | = | 0.00 ft        |
| Eccentricity          | = | 0.00 in        |
| Wall to Ftg CL Dist   | = | 0.00 ft        |
| Footing Type          |   | Spread Footing |
| Base Above/Below Soil |   |                |
| at Back of Wall       | = | 0.0 ft         |

Printed: 19 SEP 2022, 5:49PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall** LIC# : KW-06015393, Build:20.22.7.14

#### BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: SE @ Ext wall (11/S3.1)

| Design Summary                  |           |                     | Stem Construction                         |        | Bottom           |    |    |  |
|---------------------------------|-----------|---------------------|---|--------|------------------|----|----|--|
|                                 |           |                     | Decign Height Above Etc                   | -<br>" | Stem OK          |    |    |  |
| Wall Stability Ratios           |           |                     | Design Height Above Ftg                   | π=     | 0.00<br>Concrete |    |    |  |
| Overturning                     | =         | 344 OK              | Design Method                             | =      | Concrete         | 90 | 90 |  |
| Sliding                         | =         | 1.61 OK             | Thickness                                 | _      | 12.00            | 30 | 30 |  |
| Global Stability                | _         | 1 57                | Rebar Size                                | =      | # 7              |    |    |  |
| Clobal Clability                | -         | 1.07                | Rebar Spacing                             | =      | 6.00             |    |    |  |
| Total Bearing Load              | =         | 16.398 lbs          | Rebar Placed at                           | =      | Edge             |    |    |  |
| resultant ecc.                  | =         | 2.55 in             | Design Data                               |        |                  |    |    |  |
| Eccentricity withi              | n mide    | dle third           | fb/FB + fa/Fa                             | =      | 0.665            |    |    |  |
| Soil Pressure @ Toe             | =         | 1,456 psf OK        | Total Force @ Section                     |        |                  |    |    |  |
| Soll Pressure @ Heel            | =         | 1,996 psr OK        | Service Level                             | lbs =  |                  |    |    |  |
| Allowable<br>Soil Prossure Loss | =<br>Thon | 4,000 pst           | Strength Level                            | lbs =  | 6,272.0          |    |    |  |
| ACL Factored @ Toe              | -<br>_    | 2 039 nef           | MomentActual                              |        |                  |    |    |  |
| ACI Factored @ Heel             | =         | 2,794 psf           | Service Level                             | ft-# = |                  |    |    |  |
| Footing Shear @ Toe             | _         | 4.7 nsi OK          | Strength Level                            | ft-# = | 29,269.3         |    |    |  |
| Footing Shear @ Heel            | _         | 17.2 nsi OK         | MomentAllowable                           | =      | 43,991.1         |    |    |  |
| Allowable                       | _         | 75.0 psi            | ShearActual                               |        |                  |    |    |  |
|                                 |           |                     | Service Level                             | psi =  |                  |    |    |  |
| Sliding Calcs                   |           |                     | Strength Level                            | psi =  | 54.7             |    |    |  |
| Lateral Sliding Force           | =         | 4,805.0 lbs         | ShearAllowable                            | psi =  | 75.0             |    |    |  |
| less 100% Passive Force         | ə -       | 337.5 lbs           | Anet (Masonry)                            | in2 =  |                  |    |    |  |
| less 100% Friction Force        | :≡ -      | 7,379.2 lbs         | Wall Weight                               | psf =  | 150.0            |    |    |  |
| Added Force Req'd               | =         | 0.0 lbs OK          | Rebar Depth 'd'                           | in =   | 9.56             |    |    |  |
| for 1.5 Stability               | =         | 0.0 lbs OK          |   |        |                  |    |    |  |
|                                 |           |                     | Masonry Data                              |        |                  |    |    |  |
| Vertical component of active    | e latera  | al soil pressure IS | ťm  | psi =  |                  |    |    |  |
| considered in the calculation   | n of so   | il bearing pressure | es. Fs                                    | psi =  |                  |    |    |  |
| Load Factors                    |           |                     | - Madular Datia Ial                       | =      |                  |    |    |  |
| Building Code                   |           |                     | Modular Ratio n                           | =      |                  |    |    |  |
| Dead Load                       |           | 1.200               | Equiv. Solid Thick.<br>Masonry Block Type | =      |                  |    |    |  |
| Live Load                       |           | 1.600               | Masonry Design Method                     | _      |                  |    |    |  |
| Earth, H                        |           | 1.600               | Concrete Data                             | _      | 700              |    |    |  |
| Wind, W                         |           | 1.600               | f'C                                       | psi =  | 2,500.0          |    |    |  |
| Seismic, E                      |           | 1.000               | Fy  | psi =  | 60,000.0         |    |    |  |
|                                 |           |                     |   |        |                  |    |    |  |

Printed: 19 SEP 2022, 5:49PM

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

DESCRIPTION: SE @ Ext wall (11/S3.1)

#### **Concrete Stem Rebar Area Details**

Bottom Stem Vertical Reinforcing Horizontal Reinforcing As (based on applied moment) : 0.7036 in2/ft (4/3) \* As : 0.9382 in2/ft Min Stem T&S Reinf Area 4.320 in2 200bd/fy: 200(12)(9.5625)/60000: 0.3825 in2/ft 0.0018bh : 0.0018(12)(12) : 0.2592 in2/ft Horizontal Reinforcing Options : Two layers of : One layer of : \_\_\_\_\_ Required Area : #4@ 8.33 in #4@ 16.67 in 0.7036 in2/ft Provided Area : 1.2 in2/ft #5@ 12.92 in #5@ 25.83 in Maximum Area : 1.2954 in2/ft #6@ 18.33 in #6@ 36.67 in

#### **Footing Data**

| Toe Width            | =      | 1.67 ft       |
|----------------------|--------|---------------|
| Heel Width           | =      | 6.50          |
| Total Footing Width  | =      | 8.17          |
| Footing Thickness    | =      | 18.00 in      |
| Key Width            | =      | 0.00 in       |
| Key Depth            | =      | 0.00 in       |
| Key Distance from To | e =    | 0.00 ft       |
| f'c = 2,500 psi      | Fy =   | 60,000 psi    |
| Footing Concrete Den | sity = | 150.00 pcf    |
| Min. As %            | =      | 0.0000        |
| Cover @ Top 2.0      | 0 @ E  | 8tm.= 3.00 in |

BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

Project File: Foundations.ec6

Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft

#### **Footing Design Results**

|                        |      | <u>Toe</u>    | <u>Heel</u> |    |
|------------------------|------|---------------|-------------|----|
| Factored Pressure      | =    | 2,039         | 2,794 psf   |    |
| Mu' : Upward           | =    | 2,904         | 36,124 ft-# |    |
| Mu' : Downward         | =    | 375           | 57,362 ft-# |    |
| Mu: Design             | =    | 2,529 OK      | 21,238 ft-# | OK |
| phiMn                  | =    | 53,815        | 39,347 ft-# |    |
| Actual 1-Way Shear     | =    | 4.72          | 17.25 psi   |    |
| Allow 1-Way Shear      | =    | 75.00         | 75.00 psi   |    |
| Toe Reinforcing        | =    | # 6 @ 6.00 in |             |    |
| Heel Reinforcing       | =    | # 6 @ 9.02 in |             |    |
| Key Reinforcing        | =    | None Spec'd   |             |    |
| Footing Torsion, Tu    |      | =             | 0.00 ft-lbs |    |
| Footing Allow. Torsion | n, p | ohi⊤u =       | 0.00 ft-lbs |    |

#### If torsion exceeds allowable, provide

supplemental design for footing torsion.

#### Other Acceptable Sizes & Spacings

Toe: #4@ 45.41 in, #5@ 70.39 in, #6@ 99.91 in, #7@ 136.25 in, #8@ 179.40 in, #9@ 227.08 in, #10@ 288.40 in

Heel: #4@ 5.79 in, #5@ 8.97 in, #6@ 12.73 in, #7@ 17.37 in, #8@ 22.87 in, #9@ 28.95 in, #10@ 36.76 in

Key: No key defined

| Min footing T&S reinf Area          | 3.18 in2                          |
|-------------------------------------|-----------------------------------|
| Vin footing T&S reinf Area per foot | 0.39 in2 /ft                      |
| f one layer of horizontal bars:     | If two layers of horizontal bars: |
| #4@ 6.17 in                         | #4@ 12.35 in                      |
| #5@ 9.57 in                         | #5@ 19.14 in                      |
| #6@ 13.58 in                        | #6@ 27.16 in                      |
|                                     |                                   |

Printed: 19 SEP 2022, 5:49PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: SE @ Ext wall (11/S3.1)

#### Summary of Overturning & Resisting Forces & Moments

|  |        | OV           | ERTURNING      | i              |  | RE           | SISTING        |                |
|--|--------|--------------|----------------|----------------|--|--------------|----------------|----------------|
| Item   |        | Force<br>lbs | Distance<br>ft | Moment<br>ft-# |  | Force<br>Ibs | Distance<br>ft | Moment<br>ft-# |
| HL Act Pres (ab water tbl                      | )      | 4.805.0      | 5.17           | 24.825.8       | Soil Over HL (ab. water tbl)                 | 10,010.0     | 5.42           | 54,224.2       |
| HL Act Pres (be water tbl<br>Hvdrostatic Force | )      | .,           |                | _ ,,           | Soil Over HL (bel. water tbl)<br>Watre Table |              | 5.42           | 54,224.2       |
| Buoyant Force                                  | =      |              |                |                | Sloped Soil Over Heel =                      |              |                |                |
| Surcharge over Heel                            | =      |              |                |                | Surcharge Over Heel =                        |              |                |                |
| Surcharge Over Toe                             | =      |              |                |                | Adjacent Footing Load =                      |              |                |                |
| Adjacent Footing Load                          | =      |              |                |                | Axial Dead Load on Stem =                    |              |                |                |
| Added Lateral Load                             | =      |              |                |                | * Axial Live Load on Stem =                  |              |                |                |
| Load @ Stem Above Soi                          | =      |              |                |                | Soil Over Toe =                              |              |                |                |
|  | _      |              |                |                | Surcharge Over Toe =                         |              |                |                |
|  | -      |              |                |                | Stem Weight(s) =                             | 2,250.0      | 2.17           | 4,875.8        |
|  |        |              |                |                | Earth @ Stem Transitions =                   |              |                |                |
| Total  | =      | 4,805.0      | O.T.M. =       | 24,825.8       | Footing Weight =                             | 1,837.6      | 4.08           | 7,503.7        |
|  |        |              |                |                | Key Weight =                                 |              |                |                |
| Resisting/Overturning                          | g Rati | io           | =              | 3.44           | Vert. Component =                            | 2,300.6      | 8.17           | 18,789.4       |
| Vertical Loads used for                        | or Soi | I Pressure   | = 16,398.      | 2 lbs          | Total =                                      | 16,398.2 I   | bs R.M.=       | 85,393.0       |

Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus250.0pciHorizontal Defl @ Top of Wall (approximate only)0.000in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe.

because the wall would then tend to rotate into the retained soil.

Printed: 19 SEP 2022, 5:49PM **Cantilevered Retaining Wall** Project File: Foundations.ec6 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022 DESCRIPTION: SE @ Ext wall (11/S3.1) **Rebar Lap & Embedment Lengths Information** Stem Design Segment: Bottom Stem Design Height: 0.00 ft above top of footing Lap Splice length for #7 bar specified in this stem design segment = 40.95 in Development length for #7 bar specified in this stem design segment = 31.50 in Hooked embedment length into footing for #7 bar specified in this stem design segment = 8.62 in As Provided = 1.2000 in2/ft As Required = 0.7036 in2/ft

Printed: 19 SEP 2022, 5:49PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |
|                                      |                      |                               |

DESCRIPTION: SE @ Ext wall (11/S3.1)



Printed: 19 SEP 2022, 5:49PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |

DESCRIPTION: SE @ Ext wall (11/S3.1)



#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

**DESCRIPTION:** Garage Wall (12/S3.3)

#### BYKONEN CARTER QUINN

Printed: 19 SEP 2022, 4:19PM

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

#### Code Reference

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

0.00 in

0.0 ft

#### Criteria

| Retained Height        | = | 16.00 ft |  |
|------------------------|---|----------|--|
| Wall height above soil | = | 0.00 ft  |  |
| Slope Behind Wall      | = | 0.00     |  |

#### Surcharge Loads

Height of Soil over Toe =

Water height over heel =

| _   |   |                              |  |  |  |  |
|---|---|------------------------------|--|--|--|--|
| Surcharge Over Heel = 0.0 psf<br>Used To Resist Sliding & Overturning<br>Surcharge Over Toe = 0.0<br>Used for Sliding & Overturning |   |                              |  |  |  |  |
| Axial Load Applied to Stem  |   |                              |  |  |  |  |
| Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity   | = | 0.0 lbs<br>0.0 lbs<br>0.0 in |  |  |  |  |

#### **Earth Pressure Seismic Load**

Method : Uniform Multiplier Used 9.000 = (Multiplier used on soil density)

| Allow Soil Bearing<br>Equivalent Fluid Pressure | =<br>Meth | 5,332.0<br>od | psf    |
|---|-----------|---------------|--------|
| Active Heel Pressure                            | =         | 5.0           | psf/ft |
|   | =         |               |        |
| Passive Pressure                                | =         | 300.0         | psf/ft |
| Soil Density, Heel                              | =         | 130.00        | pcf    |
| Soil Density, Toe                               | =         | 130.00        | pcf    |
| Footing  Soil Friction                          | =         | 0.450         |        |
| Soil height to ignore<br>for passive pressure   | =         | 0.00          | in     |

#### Lateral Load Applied to Stem

| Lateral Load<br>Height to Top<br>Height to Bottom | =<br>=<br>= | 0.0 #/ft<br>15.00 ft<br>11.00 ft |
|---|-------------|----------------------------------|
| Load Type   | =           | Earth (H)<br>(Service Level)     |
| Wind on Exposed Sten<br>(Strength Level)          | n =         | 0.0 psf                          |

#### **Adjacent Footing Load**

| Adjacent Footing Load                    | = | 0.0 lbs        |
|--|---|----------------|
| Footing Width                            | = | 0.00 ft        |
| Eccentricity                             | = | 0.00 in        |
| Wall to Ftg CL Dist                      | = | 0.00 ft        |
| Footing Type                             |   | Spread Footing |
| Base Above/Below Soil<br>at Back of Wall | = | 0.0 ft         |
| at Baok of Wall                          |   |                |

#### Uniform Seismic Force = 157.500 Total Seismic Force = 2,756.250

Soil Data

Printed: 19 SEP 2022, 4:19PM

Project File: Foundations.ec6

#### Cantilevered Retaining Wall LIC# : KW-06015393, Build:20.22.7.14

#### BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

DESCRIPTION: Garage Wall (12/S3.3)

| Design Summary                  |           | S                   | tem Construction         |        | Bottom   |    |    |  |
|---------------------------------|-----------|---------------------|--------------------------|--------|----------|----|----|--|
|                                 |           |                     | Design Height Above Ftg  |        | Stem OK  |    |    |  |
| Wall Stability Ratios           |           |                     | Wall Material Above "Ht" | =      | Concrete |    |    |  |
| Overturning                     | =         | 2.04 OK             | Design Method            | =      | SD       | SD | SD |  |
| Sliding                         | =         | 1.28 Ratio < 1.5    | <sup>!</sup> Thickness   | =      | 12.00    | -  | -  |  |
| Global Stability                | =         | 5.62                | Rebar Size               | =      | # 5      |    |    |  |
| 2                               |           |                     | Rebar Spacing            | =      | 6.00     |    |    |  |
| Total Bearing Load              | =         | 6,280 lbs           | Rebar Placed at          | =      | Edge     |    |    |  |
| resultant ecc.                  | =         | 15.42 in            | Design Data              |        | 0.074    |    |    |  |
| Eccentricity withi              | n mid     | dle third           | tb/FB + ta/Fa            | =      | 0.971    |    |    |  |
| Soil Pressure @ Loe             | =         | 1,541 psf OK        | Total Force @ Section    |        |          |    |    |  |
|                                 | =         | 29 psi OK           | Service Level            | lbs =  |          |    |    |  |
| Allowable<br>Soil Pressure Less | =<br>Than | Sisse pst           | Strength Level           | lbs =  | 3,544.0  |    |    |  |
| ACL Factored @ Toe              | -<br>-    | 2 158 nef           | MomentActual             | e      |          |    |    |  |
| ACI Factored @ Heel             | _         | 40 psf              | Service Level            | ft-# = |          |    |    |  |
| Footing Shear @ Toe             | _         | 34.5 nei OK         | Strength Level           | ft-# = | 25,621.3 |    |    |  |
| Footing Shear @ Heel            | _         | 18.0 psi OK         | MomentAllowable          | =      | 26,382.0 |    |    |  |
| Allowable                       | _         | 75.0 psi OK         | ShearActual              |        |          |    |    |  |
| Allowable                       | -         | 75.0 psi            | Service Level            | psi =  |          |    |    |  |
| Sliding Calcs                   |           |                     | Strength Level           | psi =  | 29.0     |    |    |  |
| Lateral Sliding Force           | =         | 2,695.0 lbs         | ShearAllowable           | psi =  | 75.0     |    |    |  |
| less 100% Passive Force         | <b>-</b>  | 337.5 lbs           | Anet (Masonry)           | in2 =  |          |    |    |  |
| less 100% Friction Force        | ≡ -       | 3,117.7 lbs         | Wall Weight              | psf =  | 150.0    |    |    |  |
| Added Force Req'd               | =         | 0.0 lbs OK          | Rebar Depth 'd'          | in =   | 10.19    |    |    |  |
| for 1.5 Stability               | =         | 587.3 lbs NG        |                          |        |          |    |    |  |
|                                 |           |                     | Masonry Data             |        |          |    |    |  |
| Vertical component of active    | e later   | al soil pressure IS | f'm<br>-                 | psi =  |          |    |    |  |
| NOT considered in the calcu     | lation    | of soil bearing     | Fs                       | psi =  |          |    |    |  |
| <b>.</b>                        |           |                     | Solid Grouting           | =      |          |    |    |  |
| Load Factors<br>Building Code   |           |                     | Modular Ratio 'n'        | =      |          |    |    |  |
| Dead Load                       |           | 1 200               | Equiv. Solid Thick.      | =      |          |    |    |  |
| Live Load                       |           | 1.200               | Masonry Block Type       | =      |          |    |    |  |
| Farth H                         |           | 1.000               | Masonry Design Method    | =      | ASD      |    |    |  |
| Wind W                          |           | 1.000               | Concrete Data            | nci -  | 2 500 0  |    |    |  |
| Seismic F                       |           | 1.000               | FV                       | psi =  | 2,500.0  |    |    |  |
|                                 |           | 1.000               | гу                       | hei =  | 00,000.0 |    |    |  |

Printed: 19 SEP 2022, 4:19PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 DESCRIPTION: Garage Wall (12/S3.3)

#### **Concrete Stem Rebar Area Details**

| Bottom Stem                         | Vertical Reinforcing | Horizontal Reinforcing                                       |
|-------------------------------------|----------------------|--|
| As (based on applied moment) :      | 0.5769 in2/ft        |  |
| (4/3) * As :                        | 0.7692 in2/ft        | Min Stem T&S Reinf Area 4.608 in2                            |
| 200bd/fy : 200(12)(10.1875)/60000 : | 0.4075 in2/ft        | Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft |
| 0.0018bh : 0.0018(12)(12) :         | 0.2592 in2/ft        | Horizontal Reinforcing Options :                             |
|                                     | ===========          | One layer of : Two layers of :                               |
| Required Area :                     | 0.5769 in2/ft        | #4@ 8.33 in #4@ 16.67 in                                     |
| Provided Area :                     | 0.62 in2/ft          | #5@ 12.92 in #5@ 25.83 in                                    |
| Maximum Area :                      | 1.3801 in2/ft        | #6@ 18.33 in #6@ 36.67 in                                    |

#### **Footing Data**

| Toe Width            | =       | 6.    | .00 ft  |
|----------------------|---------|-------|---------|
| Heel Width           | =       | 2.    | .00     |
| Total Footing Width  | =       | 8.    | .00     |
| Footing Thickness    | =       | 18.   | 00 in   |
| Key Width            | =       | 0.    | 00 in   |
| Key Depth            | =       | 0.    | 00 in   |
| Key Distance from To | be =    | 0.    | 00 ft   |
| f'c = 2,500 psi      | Fy =    | 60,0  | 00 psi  |
| Footing Concrete Der | nsity = | 150.  | .00 pcf |
| Min. As %            | =       | 0.00  | 00      |
| Cover @ Top 2.0      | 00 @    | Btm.= | 3.00 in |

#### **Footing Design Results**

BYKONEN CARTER QUINN

|                       |      | <u>Toe</u>     | <u>Heel</u> |    |
|-----------------------|------|----------------|-------------|----|
| Factored Pressure     | =    | 2,158          | 40 psf      |    |
| Mu' : Upward          | =    | 29,313         | 64 ft-#     |    |
| Mu': Downward         | =    | 4,860          | 2,420 ft-#  |    |
| Mu: Design            | =    | 24,453 OK      | 2,356 ft-#  | OK |
| phiMn                 | =    | 38,943         | 6,400 ft-#  |    |
| Actual 1-Way Shear    | =    | 34.52          | 18.91 psi   |    |
| Allow 1-Way Shear     | =    | 75.00          | 40.00 psi   |    |
| Toe Reinforcing       | =    | # 5 @ 6.00 in  |             |    |
| Heel Reinforcing      | =    | None Spec'd    |             |    |
| Key Reinforcing       | =    | # 4 @ 18.00 in |             |    |
| Footing Torsion, Tu   |      | =              | 0.00 ft-lbs |    |
| Footing Allow. Torsio | n, p | hiTu =         | 0.00 ft-lbs |    |

#### If torsion exceeds allowable, provide

supplemental design for footing torsion.

#### Other Acceptable Sizes & Spacings

Toe: #4@ 4.69 in, #5@ 7.28 in, #6@ 10.33 in, #7@ 14.09 in, #8@ 18.55 in, #9@ 23.48 in, #10@ 29.82 in

Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm

Key: No key defined

| Min footing T&S reinf Area          | 3.11              | in2                     |
|-------------------------------------|-------------------|-------------------------|
| Min footing T&S reinf Area per foot | 0.39              | in2 /ft                 |
| If one layer of horizontal bars:    | <u>If two lay</u> | ers of horizontal bars: |
| #4@ 6.17 in                         | #4@ 1             | 2.35 in                 |
| #5@ 9.57 in                         | #5@ 1             | 9.14 in                 |
| #6@ 13.58 in                        | #6@ 2             | 7.16 in                 |
|                                     |                   |                         |

(c) ENERCALC INC 1983-2022

Printed: 19 SEP 2022, 4:19PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

**DESCRIPTION:** Garage Wall (12/S3.3)

#### Summary of Overturning & Resisting Forces & Moments

|   |                          | OV                         | ERTURNING      |                      |  | R                | ESISTING                 |                      |
|---|--------------------------|----------------------------|----------------|----------------------|--|------------------|--------------------------|----------------------|
| Item  |                          | Force<br>lbs               | Distance<br>ft | Moment<br>ft-#       |  | Force<br>lbs     | Distance<br>ft           | Moment<br>ft-#       |
| HL Act Pres (ab water tb<br>HL Act Pres (be water tb<br>Hydrostatic Force   | l)<br>l)                 | 765.6                      | 5.83           | 4,466.1              | Soil Over HL (ab. water tbl)<br>Soil Over HL (bel. water tbl)<br>Watre Table   | 2,080.0          | 7.50<br>7.50             | 15,600.0<br>15,600.0 |
| Buoyant Force<br>Surcharge over Heel<br>Surcharge Over Toe<br>Adjacent Footing Load<br>Added Lateral Load<br>Load @ Stem Above So | =<br>=<br>=<br>=<br>il = |                            |                |                      | Sloped Soil Over Heel =<br>Surcharge Over Heel =<br>Adjacent Footing Load =<br>Axial Dead Load on Stem =<br>* Axial Live Load on Stem =<br>Soil Over Toe = |                  |                          |                      |
| Seismic Earth Load  | =<br>=                   | 1,929.4                    | 8.75           | 16,882.0             | Surcharge Over Toe =<br>Stem Weight(s) =   | 2,400.0          | 6.50                     | 15,600.0             |
| Total   | =                        | 2,695.0                    | O.T.M. =       | 21,348.2             | Footing Weight =<br>Key Weight =   | 1,800.0          | 4.00                     | 7,200.0              |
| Resisting/Overturnin<br>Vertical Loads used f   | g Rat<br>or So           | <b>io</b><br>il Pressure ⊨ | =<br>= 6,280.0 | <b>2.04</b><br>) lbs | Vert. Component =<br>Total =   | 648.3<br>6,928.3 | 8.00<br>lbs <b>R.M.=</b> | 5,186.1<br>43,586.1  |
|   |                          |                            |                |                      | * Axial live load NOT included   | in total displa  | ved. or used fo          | r overturnina        |

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci

Horizontal Defl @ Top of Wall (approximate only) 0.086 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Axial live load NOT included in total displayed, or used for over resistance, but is included for soil pressure calculation.

Printed: 19 SEP 2022, 4:19PM **Cantilevered Retaining Wall** Project File: Foundations.ec6 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022 **DESCRIPTION:** Garage Wall (12/S3.3) **Rebar Lap & Embedment Lengths Information** Stem Design Segment: Bottom Stem Design Height: 0.00 ft above top of footing Lap Splice length for #5 bar specified in this stem design segment = 23.40 in Development length for #5 bar specified in this stem design segment = 18.00 in Hooked embedment length into footing for #5 bar specified in this stem design segment = 9.77 in As Provided = 0.6200 in2/ft As Required = 0.5769 in2/ft

Printed: 19 SEP 2022, 4:19PM

## Cantilevered Retaining Wall Project File: Foundations.ec6 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

DESCRIPTION: Garage Wall (12/S3.3)



Printed: 19 SEP 2022, 4:19PM

| Cantilevered Retaining Wall          | Project File: Foundations.ec6 |                            |
|--------------------------------------|-------------------------------|----------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN          | (c) ENERCALC INC 1983-2022 |
|                                      |                               |                            |

DESCRIPTION: Garage Wall (12/S3.3)



#### Printed: 19 SEP 2022, 4:20PM

Project File: Foundations.ec6

(c) ENERCALC INC 1983-2022

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 DESCRIPTION: Garage Wall (12/S3.3)

#### Code Reference

Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

#### Criteria

#### Soil Data

| Retained Height         | = | 16.00 ft |
|-------------------------|---|----------|
| Wall height above soil  | = | 0.00 ft  |
| Slope Behind Wall       | = | 0.00     |
| Height of Soil over Toe | = | 0.00 in  |
| Water height over heel  | = | 0.0 ft   |
|                         |   |          |

### Surcharge Loads

| Surcharge Over Heel<br>Used To Resist Slidir | =<br>ng & O\ | 0.0 psf<br>/erturning |
|--|--------------|-----------------------|
| Surcharge Over Toe                           | =            | 0.0                   |
| Used for Sliding & Ov                        | /erturni     | ng                    |
| <b>Axial Load Applie</b>                     | ed to        | Stem                  |
| Axial Dead Load                              | =            | 0.0 lbs               |

| Axial Live Load         | = | 0.0 lbs |
|-------------------------|---|---------|
| Axial Load Eccentricity | = | 0.0 in  |

| =<br>Meth | 4,000.0<br>od                      | psf  |
|-----------|------------------------------------|--|
| =         | 5.0                                | psf/ft   |
| =         |                                    |  |
| =         | 300.0                              | psf/ft   |
| =         | 130.00                             | pcf  |
| =         | 130.00                             | pcf  |
| =         | 0.450                              |  |
| =         | 0.00                               | in   |
|           | =<br>Meth<br>=<br>=<br>=<br>=<br>= | = 4,000.0<br>Method<br>= 5.0<br>= 300.0<br>= 130.00<br>= 130.00<br>= 0.450<br>= 0.00 |

BYKONEN CARTER QUINN

#### Lateral Load Applied to Stem

| Lateral Load<br>Height to Top<br>Height to Bottom | =<br>=<br>= | 0.0 #/ft<br>15.00 ft<br>11.00 ft |
|---|-------------|----------------------------------|
| Load Type   | =           | Earth (H)<br>(Service Level)     |
| Wind on Exposed Ste<br>(Strength Level)           | m =         | 0.0 psf                          |

| · · · · · |  |
|-----------|--|
| ••        |  |

#### **Adjacent Footing Load**

| Adjacent Footing Load                    | = | 0.0 lbs        |
|--|---|----------------|
| Footing Width                            | = | 0.00 ft        |
| Eccentricity                             | = | 0.00 in        |
| Wall to Ftg CL Dist                      | = | 0.00 ft        |
| Footing Type                             |   | Spread Footing |
| Base Above/Below Soil<br>at Back of Wall | = | 0.0 ft         |
| Poisson's Ratio                          | _ | 0 300          |
Printed: 19 SEP 2022, 4:20PM

Project File: Foundations.ec6

#### Cantilevered Retaining Wall LIC# : KW-06015393, Build:20.22.7.14

#### BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

**DESCRIPTION:** Garage Wall (12/S3.3)

| Desig | jn S | umn | nary |
|-------|------|-----|------|
|-------|------|-----|------|

| Wall Stability Ratios    |              |         |     |    |
|--------------------------|--------------|---------|-----|----|
| Overturning              | =            | 9.76    | Ok  | (  |
| Sliding                  | =            | 4.51    | Ök  | Ś  |
| Global Stability         | =            | 5.62    |     |    |
| Total Bearing Load       | =            | 6,280   | lbs |    |
| resultant ecc.           | =            | 16.84   | in  |    |
| Eccentricity outsid      | e middl      | e third |     |    |
| Soll Pressure @ Hool     | =            | 1 610   | psr | OK |
|                          | =            | 1,012   | psi | Οĸ |
| Allowable                | =<br>Then Al | 4,000   | pst |    |
| Soll Pressure Less       | I nan Ai     | lowable | e   |    |
| ACI Factored @ Lool      | =            | 0 057   | psr |    |
| ACI Factored @ Heer      | =            | 2,257   | psi |    |
| Footing Shear @ Toe      | =            | 10.0    | psi | OK |
| Footing Shear @ Heel     | =            | 8.8     | psi | OK |
| Allowable                | =            | 75.0    | psi |    |
| Sliding Calcs            |              |         |     |    |
| Lateral Sliding Force    | =            | 765.6   | lbs |    |
| less 100% Passive Force  | -            | 337.5   | lbs |    |
| less 100% Friction Force | <b>≡</b> - 3 | ,117.7  | lbs |    |
| Added Force Rea'd        | =            | 0.0     | lbs | OK |
| for 1.5 Stability        | =            | 0.0     | lbs | OK |
| ,                        |              |         |     |    |

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

| · · · ·       |       |
|---------------|-------|
| Load Factors  |       |
| Building Code |       |
| Dead Load     | 1.200 |
| Live Load     | 1.600 |
| Earth, H      | 1.600 |
| Wind, W       | 1.600 |
| Seismic, E    | 1.000 |
|               |       |

| Stem Construction        | _          | Bottom   |       |
|--------------------------|------------|----------|-------|
| Design Height Above Etg  | <br>f+     | Stem OK  |       |
| Wall Material Above "Ht" |            | Concrete |       |
| Design Method            | _          | SD       | 50 50 |
| Thickness                | _          | 12 00    | 66 66 |
| Rebar Size               | _          | # 5      |       |
| Rebar Spacing            | =          | 6.00     |       |
| Rebar Placed at          | =          | Edge     |       |
| Design Data              |            | •        |       |
| fb/FB + fa/Fa            | =          | 0.207    |       |
| Total Force @ Section    |            |          |       |
| Service Level            | lbs =      |          |       |
| Strength Level           | lbs =      | 1,024.0  |       |
| MomentActual             |            |          |       |
| Service Level            | ft-# =     |          |       |
| Strength Level           | ft-# =     | 5,461.3  |       |
| MomentAllowable          | =          | 26,382.0 |       |
| ShearActual              |            |          |       |
| Service Level            | psi =      |          |       |
| Strength Level           | psi =      | 8.4      |       |
| ShearAllowable           | ,<br>psi = | 75.0     |       |
| Anet (Masonry)           | in2 =      |          |       |
| Wall Weight              | psf =      | 150.0    |       |
| Rebar Depth 'd'          | in =       | 10.19    |       |
|                          | =          | 10.10    |       |
| Masonry Data             |            |          |       |
| f'm                      | psi =      |          |       |
| Fs                       | psi =      |          |       |
| Solid Grouting           | =          |          |       |
| Modular Ratio 'n'        | =          |          |       |
| Equiv. Solid Thick.      | =          |          |       |
| Masonry Block Type       | =          |          |       |
| Masonry Design Method    | =          | ASD      |       |
| Concrete Data            | noi -      | 2 500 0  |       |
|                          | psi =      | 2,000.0  |       |
| гу                       | psi =      | 00,000.0 |       |

Printed: 19 SEP 2022, 4:20PM

Project File: Foundations.ec6

### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14 DESCRIPTION: Garage Wall (12/S3.3)

#### **Concrete Stem Rebar Area Details**

| Bottom Stem                         | Vertical Reinforcing | Horizontal Reinforcing                                       |
|-------------------------------------|----------------------|--|
| As (based on applied moment) :      | 0.123 in2/ft         |  |
| (4/3) * As :                        | 0.164 in2/ft         | Min Stem T&S Reinf Area 4.608 in2                            |
| 200bd/fy : 200(12)(10.1875)/60000 : | 0.4075 in2/ft        | Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft |
| 0.0018bh : 0.0018(12)(12) :         | 0.2592 in2/ft        | Horizontal Reinforcing Options :                             |
|                                     | ===========          | One layer of : Two layers of :                               |
| Required Area :                     | 0.2592 in2/ft        | #4@ 8.33 in #4@ 16.67 in                                     |
| Provided Area :                     | 0.62 in2/ft          | #5@ 12.92 in #5@ 25.83 in                                    |
| Maximum Area :                      | 1.3801 in2/ft        | #6@ 18.33 in #6@ 36.67 in                                    |
|                                     |                      |  |

#### **Footing Data**

| Toe Width              | =    | 6.    | 00 ft   |
|------------------------|------|-------|---------|
| Heel Width             | =    | 2.    | 00      |
| Total Footing Width    | =    | 8.    | 00      |
| Footing Thickness      | =    | 18.   | 00 in   |
| Key Width              | =    | 0.    | 00 in   |
| Key Depth              | =    | 0.    | 00 in   |
| Key Distance from Toe  | =    | 0.    | 00 ft   |
| f'c = 2,500 psi        | Fy = | 60,0  | 00 psi  |
| Footing Concrete Densi | ty = | 150.  | 00 pcf  |
| Min. As %              | =    | 0.00  | 00      |
| Cover @ Top 2.00       | @    | Btm.= | 3.00 in |

#### **Footing Design Results**

BYKONEN CARTER QUINN

|                       |      | <u>Toe</u>     | <u>Heel</u> |    |
|-----------------------|------|----------------|-------------|----|
| Factored Pressure     | =    | 0              | 2,257 psf   |    |
| Mu' : Upward          | =    | 9,373          | 1,080 ft-#  |    |
| Mu' : Downward        | =    | 4,860          | 2,420 ft-#  |    |
| Mu: Design            | =    | 4,513 OK       | 1,340 ft-#  | OK |
| phiMn                 | =    | 38,943         | 6,400 ft-#  |    |
| Actual 1-Way Shear    | =    | 10.04          | 8.81 psi    |    |
| Allow 1-Way Shear     | =    | 75.00          | 40.00 psi   |    |
| Toe Reinforcing       | =    | # 5 @ 6.00 in  |             |    |
| Heel Reinforcing      | =    | None Spec'd    |             |    |
| Key Reinforcing       | =    | # 4 @ 18.00 in |             |    |
| Footing Torsion, Tu   |      | =              | 0.00 ft-lbs |    |
| Footing Allow. Torsio | n, p | ohi Tu 🛛 =     | 0.00 ft-lbs |    |
|                       |      |                |             |    |

#### If torsion exceeds allowable, provide

supplemental design for footing torsion.

#### Other Acceptable Sizes & Spacings

Toe: #4@ 25.45 in, #5@ 39.45 in, #6@ 55.99 in, #7@ 76.35 in, #8@ 100.53 in, #9@ 127.26 in, #10@ 161.62 in

Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm

Key: No key defined

| 3.11        | in2   |
|-------------|---|
| 0.39        | in2 /ft   |
| If two laye | ers of horizontal bars:   |
| #4@ 12      | 2.35 in   |
| #5@ 19      | 9.14 in   |
| #6@ 2       | 7.16 in   |
|             | 3.11<br>0.39<br><u>If two lays</u><br>#4@ 12<br>#5@ 19<br>#6@ 2 |

#### (c) ENERCALC INC 1983-2022

Printed: 19 SEP 2022, 4:20PM

Project File: Foundations.ec6

#### **Cantilevered Retaining Wall**

LIC# : KW-06015393, Build:20.22.7.14

BYKONEN CARTER QUINN

(c) ENERCALC INC 1983-2022

**DESCRIPTION:** Garage Wall (12/S3.3)

#### Summary of Overturning & Resisting Forces & Moments

|   |           | OV           | ERTURNING      | i              |  | R            | ESISTING       |                |
|---|-----------|--------------|----------------|----------------|--|--------------|----------------|----------------|
| Item  | I         | Force<br>Ibs | Distance<br>ft | Moment<br>ft-# |  | Force<br>lbs | Distance<br>ft | Moment<br>ft-# |
| HL Act Pres (ab water tbl)                      | )         | 765.6        | 5.83           | 4,466.1        | Soil Over HL (ab. water tbl)                 | 2,080.0      | 7.50           | 15,600.0       |
| HL Act Pres (be water tbl)<br>Hydrostatic Force | )         |              |                |                | Soil Over HL (bel. water tbl)<br>Watre Table |              | 7.50           | 15,600.0       |
| Buovant Force                                   | =         |              |                |                | Sloped Soil Over Heel =                      |              |                |                |
| Surcharge over Heel                             | _         |              |                |                | Surcharge Over Heel =                        |              |                |                |
| Surcharge Over Toe                              | =         |              |                |                | Adjacent Footing Load =                      |              |                |                |
| Adjacent Footing Load                           | =         |              |                |                | Axial Dead Load on Stem =                    |              |                |                |
| Added Lateral Load                              | =         |              |                |                | * Axial Live Load on Stem =                  |              |                |                |
| Load @ Stem Above Soil                          | =         |              |                |                | Soil Over Toe =                              |              |                |                |
|   | _         |              |                |                | Surcharge Over Toe =                         |              |                |                |
|   | _         |              |                |                | Stem Weight(s) =                             | 2,400.0      | 6.50           | 15,600.0       |
|   |           |              |                |                | Earth @ Stem Transitions =                   |              |                |                |
| Total   | =         | 765.6        | O.T.M. =       | 4,466.1        | Footing Weight =                             | 1,800.0      | 4.00           | 7,200.0        |
|   |           |              |                |                | Key Weight =                                 |              |                |                |
| Resisting/Overturning                           | j Ratio   |              | =              | 9.76           | Vert. Component =                            | 648.3        | 8.00           | 5,186.1        |
| Vertical Loads used for                         | or Soil F | Pressure :   | = 6,280.       | 0 lbs          | Total =                                      | 6,928.3      | lbs R.M.=      | 43,586.1       |

Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus250.0pciHorizontal Defl @ Top of Wall (approximate only)0.000in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe.

Printed: 19 SEP 2022, 4:20PM **Cantilevered Retaining Wall** Project File: Foundations.ec6 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022 **DESCRIPTION:** Garage Wall (12/S3.3) **Rebar Lap & Embedment Lengths Information** Stem Design Segment: Bottom Stem Design Height: 0.00 ft above top of footing Lap Splice length for #5 bar specified in this stem design segment = 23.40 in Development length for #5 bar specified in this stem design segment = 18.00 in Hooked embedment length into footing for #5 bar specified in this stem design segment = 6.00 in As Provided = 0.6200 in2/ft As Required = 0.2592 in2/ft

Printed: 19 SEP 2022, 4:20PM

# Cantilevered Retaining Wall Project File: Foundations.ec6 LIC# : KW-06015393, Build:20.22.7.14 BYKONEN CARTER QUINN (c) ENERCALC INC 1983-2022

**DESCRIPTION:** Garage Wall (12/S3.3)



Printed: 19 SEP 2022, 4:20PM

| Cantilevered Retaining Wall          |                      | Project File: Foundations.ec6 |
|--------------------------------------|----------------------|-------------------------------|
| LIC# : KW-06015393, Build:20.22.7.14 | BYKONEN CARTER QUINN | (c) ENERCALC INC 1983-2022    |

DESCRIPTION: Garage Wall (12/S3.3)



| cense : KW-06056595  |                     | RQUINN                                | C                        | antilevered Reta  | ining W                       | /all                     | Code: IBC 2018,A  | CI 318-14,TMS 402                                |
|--|---------------------|---------------------------------------|--------------------------|---|-------------------------------|--------------------------|---|--|
| Criteria   |                     |                                       | Soi                      | Data  |                               |                          |   |  |
| Retained Height =<br>Wall height above soil =<br>Slope Behind Wall =                               | =<br>=<br>=         | 3.00 ft<br>0.50 ft<br>0.00            | Allow<br>Equiv<br>Activ  | / Soil Bearing =<br>/alent Fluid Pressure Me<br>e Heel Pressure = | 5,332.0<br>ethod<br>: 40.0    | psf<br>psf/ft            |   |  |
| Height of Soil over Toe       =         Nater height over heel       =                             | =                   | 6.00 in<br>0.0 ft                     | Pass<br>Soil [<br>Soil [ | ive Pressure =<br>Density, Heel =<br>Density, Toe =               | : 350.0<br>: 130.00<br>: 0.00 | psf/ft<br>pcf<br>pcf     |   |  |
|  |                     |                                       | Soil for                 | neight to ignore<br>passive pressure =                            | = 12.00                       | in                       |   | •••  |
| Surcharge Loads  |                     |                                       | Lat                      | eral Load Applied   | to Stem                       |                          | Adjacent Footing  | Load   |
| Surcharge Over Heel<br>Used To Resist Sliding &<br>Surcharge Over Toe<br>Used for Sliding & Overto | & Ove<br>=<br>urnin | 0.0 psf<br>erturning<br>0.0<br>g      | Late<br>He<br>He         | ral Load =<br>ight to Top =<br>ight to Bottom =                   | 0.0 #/1<br>0.00 ft<br>0.00 ft | ft                       | Adjacent Footing Load<br>Footing Width<br>Eccentricity<br>Wall to Ftg CL Dist | = 0.0 lbs<br>= 0.00 ft<br>= 0.00 in<br>= 0.00 ft |
| Axial Load Applied   | to S                | Stem                                  | LUat                     | (   | (Service Le                   | evel)                    | Footing Type  | Line Load  |
| Axial Dead Load =<br>Axial Live Load =<br>Axial Load Eccentricity =                                | =<br>=<br>=         | 0.0 lbs<br>0.0 lbs<br>0.0 in          | Win<br>(Se               | d on Exposed Stem <sub>=</sub><br>rvice Level)                    | 0.0 ps                        | sf                       | at Back of Wall<br>Poisson's Ratio  | = 0.0 ft<br>= 0.300                              |
| Earth Pressure Sei   | smi                 | c Load                                |                          |   |                               |                          |   |  |
| Multiplier Used = (Multiplier used on soil de <b>Design Summary</b>                                | =<br>ensity         | 9.000<br>)                            | Tota                     | I Seismic Force = em Construction                                 | 132.250                       | Bottom                   |   |  |
|  |                     |                                       |                          | Design Height Above   | Ftc ft =                      | Stem OK<br>0.00          |   |  |
| Wall Stability Ratios<br>Overturning<br>Sliding  | =                   | 2.64 OK<br>1.40 Ratio                 | < 1.5!                   | Wall Material Above '<br>Design Method<br>Thickness               | "Ht" =<br>=<br>=              | Concrete<br>LRFD<br>8.00 |   |  |
| Total Bearing Loadresultant ecc.   | =                   | 902 lbs<br>0.77 in                    |                          | Rebar Size<br>Rebar Spacing<br>Rebar Placed at                    | =<br>=                        | # 4<br>12.00<br>Edgo     |   |  |
| Soil Pressure @ Toe<br>Soil Pressure @ Heel  | =                   | 281 psf O<br>396 psf O                | K<br>K                   | fb/FB + fa/Fa   | =                             | 0.081                    |   |  |
| Allowable<br>Soil Pressure Less  | =<br>Tha            | 5,332 psf<br>n Allowable              |                          | Total Force @ Secti<br>Service Level                              | on<br>Ibs =                   | 204 5                    |   |  |
| ACI Factored @ Toe<br>ACI Factored @ Heel  | =                   | 393 psf<br>554 psf                    |                          | MomentActual<br>Service Level                                     | IDS =                         | 391.5                    |   |  |
| Footing Shear @ Toe<br>Footing Shear @ Heel<br>Allowable   | =<br>=<br>=         | 1.5 psi O<br>2.8 psi O<br>75.0 psi    | K<br>K                   | Strength Level<br>MomentAllowable                                 | ft-# =<br>=                   | 443.3<br>5,412.6         |   |  |
| Sliding Calcs<br>Lateral Sliding Force<br>less 100% Passive Force                                  | =<br>= -            | 386.5 lbs<br>136.1 lbs                |                          | ShearActual<br>Service Level<br>Strength Level                    | psi =<br>psi =                | 5.2                      |   |  |
| less 100% Friction Force<br>Added Force Req'd<br>for 1.5 Stability                                 | = -<br>=<br>=       | 405.9 lbs<br>0.0 lbs Ol<br>37.7 lbs N | K<br>G                   | ShearAllowable<br>Anet (Masonry)<br>Rebar Depth ˈd'               | psi =<br>in2 =<br>in =        | 75.0<br>6.25             |   |  |
|  |                     |                                       |                          | Masonry Data  | nsi –                         |                          |   |  |

Fs

f'c

Fy

Solid Grouting

Wall Weight

Concrete Data

Modular Ratio 'n'

Short Term Factor

Equiv. Solid Thick.

Masonry Block Type

Masonry Design Method

psi =

psf =

psi =

=

=

=

=

= ASD

100.0

= Medium Weight

2,500.0 psi = 60,000.0

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

| Load Factors  |              |
|---------------|--------------|
| Building Code | IBC 2018,ACI |
| Dead Load     | 1.200        |
| Live Load     | 1.600        |
| Earth, H      | 1.600        |
| Wind, W       | 1.000        |
| Seismic, E    | 1.000        |
|               |              |

| RetainPro (c) 1987-2019, Build 11.20<br>License : KW-06056595<br>License To : BYKONEN CARTE   | 0.03.31<br>R QUINN   | Cantilevered Retaining Wall   |  |   |   | Code: IBC 2018,ACI 318-14,TMS 402-16   |
|---|--|---|--|---|---|--|
| Concrete Stem Rebar Ar  | ea Details   |   |  |   |   |  |
| Bottom Stem<br>As (based on applied moment) :   | Vertical<br>0.0166 ii  | Reinforcing<br>n2/ft  | Horizont   | al Reinfo   | rcing   |  |
| (4/3) * As :  | 0.0221 ii  | n2/ft   | Min Ster   | n T&S Re  | einf Area C   | ).672 in2  |
| 200bd/fy:200(12)(6.25)/60000:   | 0.25 in2/  | ′ft   | Min Ster   | n T&S Re  | einf Area p   | per ft of stem Height : 0.192 in2/ft   |
| 0.0018bh : 0.0018(12)(8) :  | 0.1728 ii  | n2/ft   | Horizont   | al Reinfor  | rcing Optio   | ons :  |
|   | ======   | =====   | One laye   | er of :   | Two laye  | ers of :   |
| Required Area :   | 0.1728 ii  | n2/ft   | #4@ 12   | .50 in  | #4@ 25  | 5.00 in  |
| Provided Area :   | 0.2 in2/f  | t   | #5@ 19   | .38 in  | #5@ 38  | 8.75 in  |
| Maximum Area :  | 0.8467 ii  | n2/ft   | #6@ 27   | .50 in  | #6@ 55  | 5.00 in  |
| Footing Data  |  | Footing Desi  | gn Res   | sults   |   |  |
| Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Depth=Key Distance from Toe=f'c=2,500 psiFyFooting Concrete Density=Min. As %=Cover @ Top2.00@ | 1.25 ft<br>1.00<br>2.25<br>10.00 in<br>0.00 in<br>0.00 in<br>0.00 ft<br>60,000 psi<br>150.00 pcf<br>0.0018<br>Btm= 3.00 in | Factored Pressure<br>Mu' : Upward<br>Mu' : Downward<br>Mu: Design<br>Actual 1-Way Shear<br>Allow 1-Way Shear<br>Toe Reinforcing<br>Heel Reinforcing<br>Key Reinforcing<br>Footing Torsion, Tu<br>Footing Allow. Torsi | =<br>=<br>=<br>= # 4<br>= # 4<br>= Mo<br>on, phi T | Toe<br>393<br>3,964<br>2,138<br>152<br>1.49<br>75.00<br>@ 11.11<br>@ 11.11<br>me Spec'c<br>=<br>u = | Heel<br>554<br>33<br>109<br>77<br>2.78<br>75.00<br>in<br>in<br>0.00<br>0.00 | psf<br>ft-#<br>ft-#<br>psi<br>psi<br>) ft-lbs<br>) ft-lbs                          |
|   |  | If torsion excee<br>supplemental c  | eds allow<br>lesign fo                             | able, pro   | ovide<br>  torsion.   |  |
|   |  | Other Acceptable<br>Toe: #4@ 11.11<br>Heel: #4@ 11.11<br>Key: No key def  | Sizes &<br>in, #5@<br>in, #5@<br>ined              | Spacing<br>17.22 in,<br>17.22 in,   | gs<br>#6@ 24.4<br>#6@ 24.4  | 4 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5<br>4 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 |
|   |  | Min footing T&S I<br>Min footing T&S r<br>If one layer of hor   | einf Area<br>einf Area                             | a<br>i per foot<br>ars:   | 0.49<br>0.22<br>If two la   | in2<br>in2 /ft<br>vers of horizontal bars:   |

- #4@ 11.11 in #5@ 17.22 in #6@ 24.44 in
- 0.22 in2 /t If two layers of horiz #4@ 22.22 in #5@ 34.44 in #6@ 48.89 in

| Summary of Overtui   | ning & R            | esisting Fo                 | orces & Mom          | ients  |                                    |  |                                   |
|--|---------------------|-----------------------------|----------------------|--|------------------------------------|--|-----------------------------------|
| Item   | Force<br>Ibs        | ERTURNING<br>Distance<br>ft | Moment<br>ft-#       |  | RE<br>Force<br>Ibs                 | SISTING<br>Distance<br>ft                    | Moment<br>ft-#                    |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hydrostatic Force<br>Buoyant Force =<br>Surcharge over Heel =<br>Surcharge Over Toe =<br>Adjacent Footing Load =<br>Added Lateral Load =<br>Load @ Stem Above Soil =<br>Saiamia Farth Load | 293.9               | 1.28                        | 375.5                | Soil Over HL (ab. water tbl)<br>Soil Over HL (bel. water tbl)<br>Watre Table<br>Sloped Soil Over Heel =<br>Surcharge Over Heel =<br>Adjacent Footing Load =<br>Axial Dead Load on Stem =<br>* Axial Live Load on Stem =<br>Soil Over Toe =<br>Surcharge Over Toe = | 130.0                              | 2.08<br>2.08<br>0.63                         | 270.8<br>270.8                    |
| Seismic Earth Load =   | 92.6                | 1.92                        | 177.4                | Stem Weight(s) =   | 350.0                              | 1.58   | 554.2                             |
| Total =  | 386.5               | O.T.M. =                    | 553.0                | Footing Weight =<br>Key Weight =   | 281.3                              | 1.13   | 316.4                             |
| Resisting/Overturning Ra<br>Vertical Loads used for So   | tio<br>bil Pressure | =<br>= 902.0                | <b>2.64</b><br>) lbs | Vert. Component =<br>Total =<br>* Axial live load NOT included in  | 140.7<br>902.0 ll<br>total display | 2.25 _<br>bs <b>R.M.=</b><br>ed. or used for | 316.6<br>1,458.0<br>r overturning |

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus                                  | 250.0     | рсі                      |
|---|-----------|--------------------------|
| Horizontal Defl @ Top of Wall (approximate only)              | 0.014     | in                       |
| The above calculation is not valid if the heel soil bearing p | ressure e | exceeds that of the toe, |

Earth, H

Wind, W

Seismic, E

This Wall in File: p:\studio ectypos\steinborn residence ectypos\calculations\retain schedule - site

| RetainPro (c) 1987-2019, Build<br>License : KW-06056595<br>License To : BYKONEN CA                    | 11.20.<br>ARTEF       | 03.31<br>R QUINN                            |                  | Cantilevered Retain   | ing V                                 | Vall                            | Code: IBC 2018,A  | CI 318-14,TMS 402-16                             |
|---|-----------------------|---|------------------|---|---------------------------------------|---------------------------------|---|--|
| Criteria  |                       |   |                  | Soil Data   |                                       |                                 |   |  |
| Retained Height <sup>3</sup><br>Wall height above soil <sup>3</sup><br>Slope Behind Wall <sup>3</sup> | =                     | 3.00 ft<br>0.50 ft<br>0.00                  |                  | Allow Soil Bearing = 4<br>Equivalent Fluid Pressure Metho<br>Active Heel Pressure =   | 4,000.0<br>od<br>40.0                 | ) psf<br>) psf/ft               |   |  |
| Height of Soil over Toe :<br>Water height over heel :   | =                     | 6.00 in<br>0.0 ft                           | <br>::<br> <br>: | = Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing  Soil Friction = Soil height to ignore for passive pressure = | 300.0<br>130.00<br>0.00<br>0.450      | ) psf/ft<br>) pcf<br>) pcf<br>) |   |  |
| Surcharge Loads   |                       |   |                  | Lateral Load Applied to   | Stem                                  |                                 | Adjacent Footing  | Load   |
| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Overt       | e<br>& Over<br>urning | 0.0 psf<br>rturning<br>0.0                  |                  | Lateral Load =<br>Height to Top =<br>Height to Bottom =<br>Load Type = Win  | 0.0 #<br>0.00 ft<br>0.00 ft<br>nd (W) | /ft                             | Adjacent Footing Load<br>Footing Width<br>Eccentricity<br>Wall to Ftg CL Dist | = 0.0 lbs<br>= 0.00 ft<br>= 0.00 in<br>= 0.00 ft |
| Axial Load Applied<br>Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity                   | to Si<br>=<br>=<br>=  | 0.0 lbs<br>0.0 lbs<br>0.0 in                |                  | (Service Level)   | rvice L<br>0.0 p                      | evel)<br>sf                     | Base Above/Below Soil<br>at Back of Wall<br>Poisson's Ratio                   | = 0.0 ft<br>= 0.300                              |
| Design Summary  |                       |   |                  | Stem Construction   |                                       | Bottom                          | ,   |  |
| Wall Stability Ratios<br>Overturning<br>Sliding   | =<br>=                | 2.81 OK<br>1.52 OK                          |                  | <b>Design Height Above Ftg</b><br>Wall Material Above "Ht"<br>Design Method<br>Thickness  | } ft =<br>  =<br>=<br>=               | Concrete<br>LRFD<br>8.00        | )<br>)<br>)   |  |
| Total Bearing Load<br>resultant ecc.  | =<br>=                | 590 lbs<br>3.19 in                          |                  | Rebar Size<br>Rebar Spacing<br>Rebar Placed at<br><b>Design Data</b>  | =<br>=<br>=                           | # 4<br>12.00<br>Edge            | •<br>)<br>?   |  |
| Soil Pressure @ Toe<br>Soil Pressure @ Heel<br>Allowable<br>Soil Pressure Less                        | =<br>=<br>=<br>Than   | 564 psf<br>52 psf<br>4,000 psf<br>Allowable | OK<br>OK         | fb/FB + fa/Fa<br>Total Force @ Section<br>Service Level   | =<br>Ibs =                            | 0.053                           | 3   |  |
| ACI Factored @ Toe<br>ACI Factored @ Heel<br>Footing Shear @ Toe                                      | =<br>=<br>=           | 789 psf<br>73 psf<br>3.7 psi                | ок               | Strength Level<br>MomentActual<br>Service Level   | lbs =<br>ft-# =                       | 288.0                           | )   |  |
| Footing Shear @ Heel<br>Allowable   | =<br>=                | 2.5 psi<br>75.0 psi                         | OK               | Strength Level<br>MomentAllowable<br>ShearActual  | ft-# =<br>=                           | 288.0<br>5,412.6                | )   |  |
| Lateral Sliding Force<br>less 100% Passive Force<br>less 100% Friction Force                          | =<br>e = -<br>e = -   | 293.9 lbs<br>116.7 lbs<br>328.7 lbs         |                  | Service Level<br>Strength Level<br>ShearAllowable   | psi =<br>psi =<br>psi =               | 3.8<br>75.0                     | 3   |  |
| Added Force Req'd<br>for 1.5 Stability  | =<br>=                | 0.0 lbs<br>0.0 lbs                          | OK<br>OK         | Anet (Masonry)<br>Rebar Depth ˈd'<br><b>Masonry Data</b>  | in2 =<br>in =                         | 6.25                            | 5   |  |
| Vertical component of active<br>NOT considered in the calcu   | e latera<br>ulation   | al soil pressur<br>of soil bearin           | e IS<br>g        | f'm<br>Fs<br>Solid Grouting<br>Modular Ratio 'n'<br>Wall Weight   | psi =<br>psi =<br>=<br>psf =          | 100.0                           | )   |  |
| Load Factors<br>Building Code<br>Dead Load<br>Live Load   | IBO                   | C 2018,ACI<br>1.200<br>1.600                |                  | Short Term Factor<br>Equiv. Solid Thick.<br>Masonry Block Type<br>Masonry Design Method   | -<br>=<br>=<br>=                      | Medium V<br>ASD                 | Weight  |  |

## Concrete Data

Fy

1.600

1.000

1.000

psi = 2,500.0 psi = 60,000.0

#4@ 22.22 in

#5@ 34.44 in

#6@ 48.89 in

This Wall in File: p:\studio ectypos\steinborn residence ectypos\calculations\retain schedule - site

| RetainPro (c) 1987-2019, Build 11.20.03.31<br>License : KW-06056595<br>License To : BYKONEN CARTER QUINN   | Cantilevered I   | Retaining Wall  | Code: IBC 2018,ACI 318-14,TMS 402-16   |
|--|--|---|--|
| Concrete Stem Rebar Area Detail  | S  |   |  |
| Bottom Stem<br>As (based on applied moment) :  | Vertical Reinforcing<br>0.0108 in2/ft  | Horizontal Reinforcing  | )  |
| (4/3) * As :   | 0.0144 in2/ft  | Min Stem T&S Reinf  | Area 0.672 in2   |
| 200bd/fy : 200(12)(6.25)/60000 :   | 0.25 in2/ft  | Min Stem T&S Reinf  | Area per ft of stem Height : 0.192 in2/ft  |
| 0.0018bh : 0.0018(12)(8) :   | 0.1728 in2/ft  | Horizontal Reinforcing  | g Options :  |
|  |  | One layer of : Tw   | o layers of :  |
| Required Area :  | 0.1728 in2/ft  | #4@ 12.50 in #4   | 4@ 25.00 in  |
| Provided Area :  | 0.2 in2/ft   | #5@ 19.38 in #5   | 5@ 38.75 in  |
| Maximum Area :   | 0.8467 in2/ft  | #6@ 27.50 in #6   | 6@ 55.00 in  |
| Footing Data   | Footing Des  | ign Results   |  |
| Toe Width= $1.25 \text{ fm}$ Heel Width= $0.67$ Total Footing Width= $1.92$ Footing Thickness= $10.00 \text{ im}$ Key Width= $0.00 \text{ im}$ Key Depth= $0.00 \text{ im}$ Key Distance from Toe= $0.00 \text{ fm}$ f'c = $2,500 \text{ psi}$ Fy = $60,000 \text{ pm}$ Footing Concrete Density= $150.00 \text{ pm}$ Min. As %= $0.0018$ Cover @ Top $2.00$ @ Btm== $3.000$ | t Factored Pressure<br>Mu': Upward<br>Mu': Downward<br>Mu: Design<br>Actual 1-Way Shea<br>Toe Reinforcing<br>Heel Reinforcing<br>footing Torsion, Tu<br>D in Footing Allow. Tors | $\begin{array}{c} & \textbf{Toe} \\ = & 789 \\ = & 5,936 \\ = & 2,138 \\ = & 317 \\ ar & = & 3.66 \\ r & = & 75.00 \\ = & \# 4 @ 11.11 \\ ar & = & 4 @ 11.11 \\ = & 1000 \\ \text{Spec'd} \\ J & = \\ sion, phi Tu & = \end{array}$ | Heel<br>73 psf<br>0 ft-#<br>0 ft-#<br>2.50 psi<br>75.00 psi<br>0.00 ft-lbs<br>0.00 ft-lbs  |
|  | If torsion exce<br>supplemental  | eds allowable, provid<br>design for footing tor   | e<br>sion.   |
|  | Other Acceptable<br>Toe: #4@ 11.1<br>Heel: #4@ 11.1<br>Key: No key de<br>Min footing T&S<br>Min footing T&S  | Sizes & Spacings<br>1 in, #5@ 17.22 in, #6@<br>1 in, #5@ 17.22 in, #6@<br>fined<br>reinf Area<br>reinf Area<br>per foot   | <ul> <li>24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5</li> <li>24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5</li> <li>0.41 in2</li> <li>0.22 in2 /tt</li> </ul> |

#4@ 11.11 in

#5@ 17.22 in

#6@ 24.44 in

| RetainPro (c) 1987-2019, Build<br>License : KW-06056595<br>License To : BYKONEN Ca                                  | 11.20.03.31<br>ARTER QUIN | N                            | Cantilevere    | d Retaining Wall  | Code: IBC 2018,ACI 318-14,TMS 402-16 |                           |                          |  |
|---|---------------------------|------------------------------|----------------|---|--------------------------------------|---------------------------|--------------------------|--|
| Summary of Overt  | urning & R                | esisting F                   | orces & Mon    | nents   |                                      |                           |                          |  |
| Item  | Force<br>Ibs              | /ERTURNING<br>Distance<br>ft | Moment<br>ft-# |   | RE<br>Force<br>Ibs                   | SISTING<br>Distance<br>ft | Moment<br>ft-#           |  |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hydrostatic Force                                       | 293.9                     | 1.28                         | 375.5          | Soil Over HL (ab. water tbl<br>Soil Over HL (bel. water tb<br>Watre Table   | ) 0.1<br>I)                          | 1.92<br>1.92              | 0.2<br>0.2               |  |
| Buoyant Force =<br>Surcharge over Heel =<br>Surcharge Over Toe =<br>Adjacent Footing Load =<br>Added Lateral Load = | -<br>-<br>-<br>-          |                              |                | Sloped Soil Over Heel =<br>Surcharge Over Heel =<br>Adjacent Footing Load =<br>Axial Dead Load on Stem =<br>* Axial Live Load on Stem = | :<br>:<br>:                          |                           |                          |  |
| Load @ Stem Above Soil =<br>=   | =                         |                              |                | Soil Over Toe =<br>Surcharge Over Toe =   | :<br>:                               | 0.63                      | 554.0                    |  |
| Total   | 203.0                     |                              | 375.5          | Earth @ Stem Transitions=   | = 350.0<br>=                         | 1.58                      | 554.2                    |  |
| Resisting/Overturning F   | atio                      | =                            | 2.81           | Footing Weight =<br>Key Weight =<br>Vert. Component =   | = 239.6<br>= 140.7                   | 0.96<br>1.92              | 229.7<br>269.7           |  |
| Vertical Loads used for   | Soil Pressure             | = 589.                       | 8 lbs          |   | = 730.5 l<br>d in total display      | bs <b>R.M.=</b>           | 1,053.8<br>r overturning |  |

<sup>4</sup> Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus                                    | 250.0    | pci                      |
|---|----------|--------------------------|
| Horizontal Defl @ Top of Wall (approximate only)                | 0.029    | in                       |
| The above calculation is not valid if the heel soil bearing pre | essure e | exceeds that of the toe, |

| RetainPro (c) 1987-2019, Build<br>License : KW-06056595<br>License To : BYKONEN CA   | 11.20.0   | 03.31<br>R QUINN                                       | (   | Cantilevered Reta   | aining V   | Vall                                     | Code: IBC 2018,A   | CI 318-14,TMS 402-16   |
|--|---|--|---|---|--|--|--|--|
| Criteria   |   |  | So  | il Data   |  |  |  |  |
| Retained Height =<br>Wall height above soil =<br>Slope Behind Wall =<br>Height of Soil over Toe =<br>Water height over heel =                                  | =<br>=<br>=                                     | 8.00 ft<br>0.50 ft<br>0.00<br>6.00 in<br>0.0 ft        | Allov<br>Equ<br>Activ<br>Pass<br>Soil<br>Soil<br>Foot<br>Soil | w Soil Bearing  | = 5,332.0<br>ethod<br>= 40.0<br>= 300.0<br>= 130.00<br>= 130.00<br>= 0.450<br>= 0.00 | psf<br>psf/ft<br>psf/ft<br>pcf<br>pcf    |  |  |
| Surcharge Loads  |   |  | La  | teral Load Applied  | to Stem  |  | Adjacent Footing   | Load   |
| Surcharge Over Heel<br>Used To Resist Sliding &<br>Surcharge Over Toe<br>Used for Sliding & Overtu<br>Axial Load Applied<br>Axial Dead Load<br>Axial Live Load | & Over<br>=<br>urning<br><b>to St</b><br>=<br>= | 0.0 psf<br>turning<br>0.0<br>tem<br>0.0 lbs<br>0.0 lbs | Late<br>H<br>Loa<br>Win<br>(S                                 | eral Load =<br>eight to Top =<br>eight to Bottom =<br>d Type =<br>nd on Exposed Stem =<br>ervice Level) | 0.0 #/<br>0.00 ft<br>0.00 ft<br>Wind (W)<br>(Service Le<br>0.0 ps                    | /ft<br>evel)<br>sf                       | Adjacent Footing Load<br>Footing Width<br>Eccentricity<br>Wall to Ftg CL Dist<br>Footing Type<br>Base Above/Below Soil<br>at Back of Wall<br>Poisson's Ratio | = 0.0 lbs<br>= 0.00 ft<br>= 0.00 in<br>= 0.00 ft<br>Line Load<br>= 0.0 ft<br>= 0.300 |
| Earth Procesure Soi  | =<br>cmio                                       |  |   |   |  |  |  |  |
| Laith Flessure Sei   | Sinic   | LUau   |   |   |  |  |  |  |
| Method : Uniform<br>Multiplier Used =<br>(Multiplier used on soil de   | = 9<br>ensity)                                  | 9.000  | Unif<br>Tota  | iorm Seismic Force = al Seismic Force =   | 82.500<br>756.250  |  |  |  |
| Design Summary   |   |  | S   | tem Construction  |  | Bottom<br>Stem OK                        |  |  |
| Wall Stability Ratios<br>Overturning<br>Sliding  | =   | 2.66 Ok<br>1.23 Rat                                    | ;<br>io < 1.5!  | Design Height Above<br>Wall Material Above<br>Design Method<br>Thickness<br>Rebar Size                  | <b>Ftg</b> ft =<br>"Ht" =<br>=<br>=  | 0.00<br>Concrete<br>LRFD<br>12.00<br># 5 |  |  |
| Total Bearing Loadresultant ecc.   | =   | 3,230 lbs<br>13.72 in                                  |   | Rebar Spacing<br>Rebar Placed at  | =  | 12.00<br>Edge                            |  |  |
| Soil Pressure @ Toe<br>Soil Pressure @ Heel<br>Allowable<br>Soil Pressure Less   | =<br>=<br>Than                                  | 750 psf<br>58 psf<br>5,332 psf<br>Allowable            | OK<br>OK  | fb/FB + fa/Fa<br>Total Force @ Sect<br>Service Level  | =<br>ion<br>lbs =  | 0.591                                    |  |  |
| ACI Factored @ Toe<br>ACI Factored @ Heel<br>Footing Shear @ Toe   | =<br>=  | 1,050 psf<br>81 psf                                    | OK  | Strength Level<br>MomentActual<br>Service Level   | lbs =<br>ft-# =  | 2,708.0                                  |  |  |
| Footing Shear @ Heel<br>Allowable  | =<br>=  | 0.0 psi<br>75.0 psi                                    | OK  | Strength Level<br>MomentAllowable   | ft-# =<br>e =  | 8,101.3<br>13,701.3                      |  |  |
| Lateral Sliding Force<br>less 100% Passive Force<br>less 100% Friction Force   | =<br>= -<br>= -                                 | 2,209.9 lbs<br>1,066.7 lbs<br>1,641.9 lbs              |   | Service Level<br>Strength Level<br>ShearAllowable   | psi =<br>psi =<br>psi =  | 22.2<br>75.0                             |  |  |
| Added Force Req'd<br>for 1.5 Stability   | =<br>=  | 0.0 lbs<br>606.4 lbs                                   | OK<br>NG  | Anet (Masonry)<br>Rebar Depth 'd'<br><b>Masonry Data</b>  | in2 =<br>in =  | 10.19                                    |  |  |
| Vertical component of active   | e latera  | al soil pressu<br>of soil bearin                       | e IS  | f'm<br>Fs<br>Solid Grouting<br>Modular Ratio 'n'  | psi =<br>psi =<br>=<br>=   |  |  |  |

Wall Weight

Concrete Data

f'c

Fy

Short Term Factor

Equiv. Solid Thick.

Masonry Block Type

Masonry Design Method

150.0

= Medium Weight

2,500.0

psf=

psi =

=

=

= ASD

psi = 60,000.0

| Load Factors  |              |
|---------------|--------------|
| Building Code | IBC 2018,ACI |
| Dead Load     | 1.200        |
| Live Load     | 1.600        |
| Earth, H      | 1.600        |
| Wind, W       | 1.000        |
| Seismic, E    | 1.000        |
|               |              |

| RetainPro (c) 1987-2019, Build 11.20.03.3<br>License : KW-06056595<br>License To : BYKONEN CARTER QL | 1<br>IINN               | Cantilevered F  | Retaining Wall  | Code: IBC 2018,ACI 318-14,TMS 402-16   |
|--|-------------------------|---|---|--|
| Concrete Stem Rebar Area   | Details                 |   |   |  |
| Bottom Stem<br>As (based on applied moment) :  | Vertical I<br>0.1824 ir | Reinforcing<br>n2/ft  | Horizontal Reinforcing  |  |
| (4/3) * As :   | 0.2432 ir               | n2/ft   | Min Stem T&S Reinf Area   | a 2.448 in2  |
| 200bd/fy : 200(12)(10.1875)/60000 :  | 0.4075 ir               | n2/ft   | Min Stem T&S Reinf Area   | a per ft of stem Height : 0.288 in2/ft   |
| 0.0018bh : 0.0018(12)(12) :  | 0.2592 ir               | n2/ft   | Horizontal Reinforcing Or   | ptions :   |
|  |                         |   | One layer of : Two la   | avers of :   |
| Required Area :  | 0.2592 ir               | n2/ft   | #4@ 8.33 in #4@   | 16.67 in   |
| Provided Area :  | 0.31 in2/               | ft  | #5@ 12.92 in #5@  | 25.83 in   |
| Maximum Area :   | 1.3801 ir               | n2/ft   | #6@ 18.33 in #6@  | 36.67 in   |
| Footing Data   |                         | Footing Des   | an Results  |  |
| Toe Width =  | 7.00 ft                 |   | Toe Hee   | el   |
| Heel Width =   | 1.00                    | Factored Pressure   | = 1,050 8   | <br>B1 psf   |
| Total Footing Width =  | 8.00                    | Mu' : Upward  | = 225,560   | 0 ft-#   |
| Footing Thickness = 1  | 4.00 in                 | Mu' : Downward  | = 84,672  | 0 ft-#   |
| Key Width =  | 8 00 in                 | Mu: Design  | = 11,/41  | 0 ft-#   |
| Key Depth = 1  | 2.00 in                 | Actual 1-Way Shea   | r = 1/./4 	0.0  | JU psi   |
| Key Distance from Toe =  | 0.00 ft                 | Too Reinforcing   | = 75.00 0.0<br>- #5 @ 10.00 in  | Ju psi   |
| $f'_{c} = 2500  \text{psi}$ Ev = 60  | 000 nsi                 | Heel Reinforcing  | = #5 @ 10.00 in   |  |
| Footing Concrete Density = 15  | 0.00 pcf                | Key Reinforcing   | = #4 @ 13.88 in   |  |
| Min. As % = 0.0  | 0018                    | Footing Torsion, Tu   | = 0.  | .00 ft-lbs   |
| Cover @ Top 2.00 @ Btm.=   | = 3.00 in               | Footing Allow. Tors   | ion, phi Tu = 0.  | .00 ft-lbs   |
|  |                         | If torsion excee  | eds allowable, provide  |  |
|  |                         | supplemental of   | lesign for footing torsion  | n.   |
|  |                         | Other Acceptable  | Sizes & Spacings  |  |
|  |                         | Toe: #4@ 7.02 i<br>Heel: #4@ 7.93 i<br>Key: #4@ 13.88       | n, #5@ 10.88 in, #6@ 15.<br>n, #5@ 12.30 in, #6@ 17.<br>⊱in, #5@ 18 in, #6@ 18 in | .45 in, #7@ 21.07 in, #8@ 27.74 in, #9@ 35<br>.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39<br>n, #7@ 18 in, #8@ 18 i |
|  |                         | Min footing T&S<br>Min footing T&S r<br>If one layer of hor | reinf Area 2.4<br>einf Area per foot 0.3<br>rizontal bars: If two                 | 42 in2<br>30 in2 /ft<br>) layers of horizontal bars:   |

#4@ 7.94 in #5@ 12.30 in #6@ 17.46 in If two layers of ho #4@ 15.87 in #5@ 24.60 in #6@ 34.92 in

| RetainPro (c) 1987-2019, Bu<br>License : KW-06056595<br>License To : BYKONEN  | uild 11<br>CAR                    | .20.03.31<br>TER QUINN   | J                           | Cantilevere          | d Retaining Wall   | Code: IBC 20   | Code: IBC 2018,ACI 318-14,TMS 402-16 |                |  |  |
|---|-----------------------------------|--------------------------|-----------------------------|----------------------|--|--|--------------------------------------|----------------|--|--|
| Summary of Ove  | rtur                              | ning & R                 | esisting F                  | orces & Mon          | nents  |  |                                      |                |  |  |
| Item  |                                   | OV<br>Force<br>Ibs       | ERTURNING<br>Distance<br>ft | Moment<br>ft-#       |  | RE<br>Force<br>Ibs                                   | SISTING<br>Distance<br>ft            | Moment<br>ft-# |  |  |
| HL Act Pres (ab water tb<br>HL Act Pres (be water tb<br>Hydrostatic Force<br>Buoyant Force<br>Surcharge over Heel<br>Surcharge Over Toe<br>Adjacent Footing Load<br>Added Lateral Load<br>Load @ Stem Above Soi | I)<br>I)<br>=<br>=<br>=<br>=<br>= | 1,680.6                  | 3.06                        | 5,135.0              | Soil Over HL (ab. water th<br>Soil Over HL (bel. water th<br>Watre Table<br>Sloped Soil Over Heel<br>Surcharge Over Heel<br>Adjacent Footing Load<br>Axial Dead Load on Stem<br>* Axial Live Load on Stem<br>Soil Over Toe | bl)<br>=<br>=<br>=<br>=<br>=<br>=<br>=<br>=<br>455.0 | 3.50                                 | 1,592.5        |  |  |
| Seismic Earth Load  | =                                 | 529.4                    | 4.58                        | 2,426.3              | Surcharge Over Toe<br>Stem Weight(s)   | =<br>= 1,275.0                                       | 7.50                                 | 9,562.5        |  |  |
| Total   | =                                 | 2,209.9                  | O.T.M. =                    | 7,561.3              | Footing Weight   | = 1,400.0  | 4.00                                 | 5,600.0        |  |  |
| Resisting/Overturning<br>Vertical Loads used f  | <b>g Rat</b><br>or So             | <b>io</b><br>il Pressure | =<br>= 3,230.               | <b>2.66</b><br>0 lbs | Vert. Component  | = 418.6<br>= 3,648.6                                 | 8.00<br>s <b>R.M.=</b>               | 3,348.7        |  |  |
| If seismic is included th   | e OTI                             | M and slidin             | a ratios                    |                      | * Axial live load NOT includ<br>resistance, but is included  | ed in total display                                  | ed, or used fo<br>calculation.       | r overturning  |  |  |

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus | 250.0 pci |
|------------------------------|-----------|
|------------------------------|-----------|

Horizontal Defl @ Top of Wall (approximate only) 0.022 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

| This Wall in File: p:\studio e  | ctypos\steinborn   | residenc                | ce ectypos\calculations\retain sc   | hedule   | e - site                                 |   |   |
|---|--|-------------------------|---|--|--|---|---|
| RetainPro (c) 1987-2019, Build<br>License : KW-06056595<br>License To : BYKONEN C   | d 11.20.03.31<br>ARTER QUINN   |                         | Cantilevered Retaini  | ng V   | Vall                                     | Code: IBC 2018,A  | CI 318-14,TMS 402-16  |
| Criteria  |  |                         | Soil Data   |  |  |   |   |
| Retained Height<br>Wall height above soil<br>Slope Behind Wall<br>Height of Soil over Toe<br>Water height over heel                     | = 8.00 ft<br>= 0.50 ft<br>= 0.00<br>= 6.00 in<br>= 0.0 ft                | F<br>S<br>S<br>S<br>S   | Allow Soil Bearing       =       4         Equivalent Fluid Pressure Metho         Active Heel Pressure       =         Passive Pressure       =         Soil Density, Heel       =         Soil Density, Toe       =         Footing  Soil Friction       =         Soil height to ignore       for passive pressure       = | ,000.0<br>1<br>300.0<br>130.00<br>130.00<br>0.450<br>0.00  | psf/ft<br>psf/ft<br>pcf<br>pcf<br>in     |   |   |
| Surcharge Loads   |  |                         | Lateral Load Applied to   | Stem   |  | Adjacent Footing  | Load  |
| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Over<br>Axial Load Applied<br>Axial Dead Load | = 0.0 psf<br>& Overturning<br>= 0.0<br>turning<br>I to Stem<br>= 0.0 lbs |                         | Lateral Load =<br>Height to Top =<br>Height to Bottom =<br>Load Type = Win<br>(Ser<br>Wind on Exposed Stem =  | 0.0 #/<br>0.00 ft<br>0.00 ft<br>d (W)<br>vice Le<br>0.0 p: | /ft<br>evel)<br>sf                       | Adjacent Footing Load<br>Footing Width<br>Eccentricity<br>Wall to Ftg CL Dist<br>Footing Type<br>Base Above/Below Soil<br>at Back of Wall | = 0.0 lbs<br>= 0.00 ft<br>= 0.00 in<br>= 0.00 ft<br>Line Load<br>= 0.0 ft |
| Axial Live Load<br>Axial Load Eccentricity  | = 0.0 lbs<br>= 0.0 in  |                         | (Service Level)   |  |  | Poisson's Ratio   | = 0.300   |
| Design Summary  |  |                         | Stem Construction   | ] –  | Bottom<br>Stem OK                        |   |   |
| Wall Stability Ratios<br>Overturning<br>Sliding   | = 3.92<br>= 1.61   | OK<br>OK                | Design Height Above Ftg<br>Wall Material Above "Ht"<br>Design Method<br>Thickness<br>Rebar Size   | ft =<br>=<br>=<br>=  | 0.00<br>Concrete<br>LRFD<br>12.00<br># 5 |   |   |
| Total Bearing Load<br>resultant ecc.  | = 3,230 ll<br>= 4.71 i   | วร<br>า                 | Rebar Spacing<br>Rebar Placed at  | =  | 12.00<br>Edge                            |   |   |
| Soil Pressure @ Toe<br>Soil Pressure @ Heel<br>Allowable<br>Soil Pressure Less  | = 523 p<br>= 285 p<br>= 4,000 p<br>s Than Allowable                      | osf OK<br>osf OK<br>osf | fb/FB + fa/Fa<br>Total Force @ Section<br>Service Level   | =<br>Ibs =   | 0.398                                    |   |   |
| ACI Factored @ Toe<br>ACI Factored @ Heel   | = 732 p<br>= 399 p   | osf<br>osf              | Strength Level<br>MomentActual  | lbs =  | 2,048.0                                  |   |   |
| Footing Shear @ Toe<br>Footing Shear @ Heel<br>Allowable<br>Sliding Calcs   | = 14.1 p<br>= 0.0 p<br>= 75.0 p  | osi OK<br>osi OK<br>osi | Strength Level<br>MomentAllowable<br>ShearActual  | ft-# =<br>=  | 5,461.3<br>13,701.3                      |   |   |
| Lateral Sliding Force<br>less 100% Passive Force<br>less 100% Friction Force  | = 1,680.6  lk<br>e = - 1,066.7  lk<br>e = - 1,641.9  lk                  | os<br>os<br>os          | Service Level<br>Strength Level<br>ShearAllowable   | psi =<br>psi =<br>psi =                                    | 16.8<br>75.0                             |   |   |
| Added Force Req'd<br>for 1.5 Stability  | = 0.0 ll<br>= 0.0 l  | bs OK<br>bs OK          | Anet (Masonry)<br>Rebar Depth 'd'<br>Masonry Data<br>f'm  | in2 =<br>in =<br>psi =                                     | 10.19                                    |   |   |
| Vertical component of activ<br>NOT considered in the calc   | e lateral soil pres<br>ulation of soil bea                               | sure IS<br>aring        | Fs<br>Solid Grouting<br>Modular Ratio 'n'<br>Wall Weight  | psi =<br>=<br>=<br>psf =                                   | 150.0                                    |   |   |
| Load Factors<br>Building Code<br>Dead Load<br>Live Load<br>Farth H  | IBC 2018,AC<br>1.200<br>1.600<br>1.600                                   | <br>)<br>)              | Short Term Factor<br>Equiv. Solid Thick.<br>Masonry Block Type<br>Masonry Design Method   | =<br>=<br>=  | Medium V<br>ASD                          | Veight  |   |
| Wind, W<br>Seismic, E   | 1.000  | )                       | f'c<br>Fy   | psi =<br>psi =   | 2,500.0<br>60,000.0                      |   |   |

| RetainPro (c) 1987-2019, Build 11.20.03.3<br>License : KW-06056595<br>License To : BYKONEN CARTER QU  | Cantilev   | vered Retaining W   | Code: IBC 2018,ACI 318-14,TMS 402-16  |
|---|--|---|---|
| Concrete Stem Rebar Area  | Details  |   |   |
| Bottom Stem<br>As (based on applied moment) :   | Vertical Reinforcing<br>0.123 in2/ft   | Horizontal Reinf  | prcing  |
| (4/3) * As :  | 0.164 in2/ft   | Min Stem T&S F  | einf Area 2.448 in2   |
| 200bd/fy : 200(12)(10.1875)/60000 :   | 0.4075 in2/ft  | Min Stem T&S F  | einf Area per ft of stem Height : 0.288 in2/ft  |
| 0.0018bh : 0.0018(12)(12) :   | 0.2592 in2/ft  | Horizontal Reinf  | orcing Options :  |
|   |  | One layer of :  | Two layers of :   |
| Required Area :   | 0.2592 in2/ft  | #4@ 8.33 in   | #4@ 16.67 in  |
| Provided Area :   | 0.31 in2/ft  | #5@ 12.92 in  | #5@ 25.83 in  |
| Maximum Area :  | 1.3801 in2/ft  | #6@ 18.33 in  | #6@ 36.67 in  |
| Footing Data  | Footi  | ng Design Results   |   |
| Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Depth=Key Distance from Toe=f'c =2,500 psiFy =footing Concrete Density=Min. As %=0.0Cover @ Top2.00@ Btm.= | 7.00 ft         Factored           1.00         Mu': Upw           8.00 in         Mu': Dow           8.00 in         Actual 1-V           2.00 in         Actual 1-V           0.00 ft         Toe Reinf           ,000 psi         Heel Reinf           0.00 pcf         Key Reinf           0018         Footing To           = 3.00 in         Footing All | Toe           Pressure         732           ard         186,550           nward         84,672           gn         8,490           Vay Shear         14.11           'ay Shear         75.00           orcing         # 5 @ 10.0           forcing         # 4 @ 13.8           orsion, Tu         =           low. Torsion, phi Tu         = | Heel<br>399 psf<br>0 ft-#<br>0 ft-#<br>0 ft-#<br>0.00 psi<br>0.00 psi<br>0 in<br>0 in<br>8 in<br>0.00 ft-lbs<br>0.00 ft-lbs                             |
|   | If tors  | ion exceeds allowable, p  | rovide  |
|   | supple   | emental design for footin   | g torsion.  |
|   | Other Acc<br>Toe: #<br>Heel: #<br>Key: #<br>Min foo  | Sizes & Spacin           4@ 7.93 in, #5@ 12.30 in,           4@ 7.93 in, #5@ 12.30 in,           4@ 13.88 in, #5@ 18 in, #           ting T&S reinf Area  | gs<br>#6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39<br>#6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39<br>6@ 18 in, #7@ 18 in, #8@ 18 i<br>2.42 in2 |
|   | If one la  | iver of horizontal bars:  | If two layers of horizontal bars:   |

#4@ 7.94 in

#5@ 12.30 in

#6@ 17.46 in

#4@ 15.87 in

#5@ 24.60 in

#6@ 34.92 in

| RetainPro (c) 1987-2019, Build<br>License : KW-06056595<br>License To : BYKONEN CA          | 11.20.03.31<br>RTER QUIN | N                            | Cantilevere            | d Retaining Wall   | C                 | Code: IBC 2018,ACI 318-14,TMS 402-16 |                           |                            |  |
|---|--------------------------|------------------------------|------------------------|--|-------------------|--------------------------------------|---------------------------|----------------------------|--|
| Summary of Overtu   | urning & R               | esisting F                   | orces & Mon            | nents  |                   |                                      |                           |                            |  |
| ltem  | ON<br>Force<br>الbs      | /ERTURNING<br>Distance<br>ft | G<br>Moment<br>ft-#    | _  |                   | RE<br>Force<br>Ibs                   | SISTING<br>Distance<br>ft | Moment<br>ft-#             |  |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hydrostatic Force               | 1,680.6                  | 3.06                         | 5,135.0                | Soil Over HL (ab. water<br>Soil Over HL (bel. water<br>Watre Table   | tbl)<br>tbl)      |                                      |                           |                            |  |
| Buoyant Force =<br>Surcharge over Heel =<br>Surcharge Over Toe =<br>Adjacent Footing Load = |                          |                              |                        | Sloped Soil Over Heel<br>Surcharge Over Heel<br>Adjacent Footing Load<br>Axial Dead Load on Ster<br>* Axial Live Load on Sterr | =<br>=<br>m=<br>= |                                      |                           |                            |  |
| Load @ Stem Above Soil =  |                          |                              |                        | Soil Over Toe<br>Surcharge Over Toe  | =<br>=            | 455.0                                | 3.50                      | 1,592.5                    |  |
|   |                          |                              |                        | Stem Weight(s)   | =                 | 1,275.0                              | 7.50                      | 9,562.5                    |  |
| Total =   | 1,680.6<br>atio          | O.T.M. =                     | 5,135.0<br><b>3.92</b> | Footing Weight<br>Key Weight<br>Vert. Component  | =<br>=<br>=<br>=  | 1,400.0<br>100.0<br>418.6            | 4.00<br>0.33<br>8.00      | 5,600.0<br>33.3<br>3,348.7 |  |
| Vertical Loads used for S   | Soil Pressure            | = 3,230.                     | .0 lbs                 | Tot<br>* Axial live load NOT inclu   | al =<br>Ided in   | 3,648.6 Il                           | os <b>R.M.=</b>           | 20,137.0                   |  |

resistance, but is included in total displayed, or used for overturning

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus   | 250.0     | pci                      |
|--|-----------|--------------------------|
| Horizontal Defl @ Top of Wall (approximate only)                     | 0.015     | in                       |
| <u>The above calculation is not valid if the heel soil bearing p</u> | ressure e | exceeds that of the toe, |
|  |           |                          |

| RetainPro (c) 1987-2019, Build<br>License : KW-06056595<br>License To : BYKONEN CA   | 11.20<br>RTE                         | .03.31<br>R QUINN                                       |   | Cantilevered Retain   | ning V   | Code: IBC 2018,ACI 318-14,TMS 402-16     |   |   |  |
|--|--------------------------------------|---|---|---|--|--|---|---|--|
| Criteria   |                                      |   | So  | il Data   |  |  |   |   |  |
| Retained Height<br>Wall height above soil<br>Slope Behind Wall<br>Height of Soil over Toe<br>Water height over heel  | =<br>=<br>=                          | 9.00 ft<br>0.50 ft<br>0.00<br>6.00 in<br>0.0 ft         | Allo<br>Equ<br>Acti<br>Pas<br>Soil<br>Soil<br>Foo<br>Soil | w Soil Bearing =<br>ivalent Fluid Pressure Meth<br>ve Heel Pressure =<br>sive Pressure =<br>Density, Heel =<br>Density, Toe =<br>ting  Soil Friction =<br>height to ignore<br>or passive pressure = | 5,332.0<br>aod<br>300.0<br>130.00<br>130.00<br>0.450<br>0.00   | psf<br>psf/ft<br>psf/ft<br>pcf<br>pcf    |   |   |  |
| Surcharge Loads  |                                      |   | La  | teral Load Applied to   | o Stem   |  | Adjacent Footing  | Load  |  |
| Surcharge Over Heel<br>Used To Resist Sliding a<br>Surcharge Over Toe<br>Used for Sliding & Overt<br><b>Axial Load Applied</b><br>Axial Dead Load<br>Axial Live Load | =<br>=<br>urning<br><b>to S</b><br>= | 0.0 psf<br>rturning<br>0.0<br>tem<br>0.0 lbs<br>0.0 lbs | Lat<br>H<br>H<br>Loa<br>Wi                                | eral Load =<br>eight to Top =<br>eight to Bottom =<br>nd Type = W<br>(S<br>nd on Exposed Stem =<br>ervice Level)  | 0.0 #/<br>0.00 ft<br>0.00 ft<br>ind (W)<br>ervice Le<br>0.0 ps | (ft<br>evel)<br>sf                       | Adjacent Footing Load<br>Footing Width<br>Eccentricity<br>Wall to Ftg CL Dist<br>Footing Type<br>Base Above/Below Soil<br>at Back of Wall | = 0.0 lbs<br>= 0.00 ft<br>= 0.00 in<br>= 0.00 ft<br>Line Load<br>= 0.0 ft |  |
| Axial Load Eccentricity  | =                                    | 0.0 in  | (0  |   |  |  | Poisson's Ratio   | = 0.300   |  |
| Method : Uniform<br>Multiplier Used<br>(Multiplier used on soil de   | =<br>ensity)                         | 9.000   | Uni<br>Tot  | form Seismic Force = 9<br>al Seismic Force = 9<br>tem Construction  | 91.500<br>30.250   | Bottom                                   |   |   |  |
| Design Summary   |                                      |   |   | Design Height Above F   |  | Stem OK                                  |   |   |  |
| Wall Stability Ratios<br>Overturning<br>Sliding  | =                                    | 2.62 OK<br>1.20 Ratio                                   | 0 < 1.5   | Wall Material Above F<br>Wall Material Above "H<br>Design Method<br>Thickness<br>Rebar Size   | rtg ft =<br> t" =<br>=<br>=                                    | 0.00<br>Concrete<br>LRFD<br>12.00<br># 5 |   |   |  |
| I otal Bearing Loadresultant ecc.  | =                                    | 3,747 lbs<br>17.32 in                                   |   | Rebar Spacing<br>Rebar Placed at  | =  | 8.00<br>Edge                             |   |   |  |
| Soil Pressure @ Toe<br>Soil Pressure @ Heel<br>Allowable   | =<br>=<br>=                          | 784 psf(<br>26 psf(<br>5,332 psf                        | OK<br>OK  | fb/FB + fa/Fa<br>Total Force @ Section  | =<br>n<br>lbs =  | 0.569                                    | ,   |   |  |
| ACI Factored @ Toe<br>ACI Factored @ Heel  | I han<br>=<br>=                      | Allowable<br>1,098 psf<br>36 psf                        |   | Strength Level<br>MomentActual<br>Service Level   | lbs =  | 3,415.5                                  |   |   |  |
| Footing Shear @ Toe<br>Footing Shear @ Heel<br>Allowable   | =<br>=<br>=                          | 21.1 psi (<br>0.0 psi (<br>75.0 psi                     | DK<br>DK  | Strength Level<br>MomentAllowable   | ft-# =<br>=  | 11,481.8<br>20,169.2                     |   |   |  |
| Lateral Sliding Force<br>less 100% Passive Force<br>less 100% Friction Force   | =<br>= -<br>= -                      | 2,718.4 lbs<br>1,350.0 lbs<br>1,917.7 lbs               |   | Service Level<br>Strength Level<br>ShearAllowable   | psi =<br>psi =<br>psi =  | 27.9<br>75.0                             |   |   |  |
| Added Force Req'd<br>for 1.5 Stability   | =<br>=                               | 0.0 lbs (<br>809.9 lbs l                                | ok<br>Ng  | Anet (Masonry)<br>Rebar Depth 'd'<br>Masonry Data   | in2 =<br>in =  | 10.19                                    |   |   |  |
| Vertical component of active NOT considered in the calcu   | e later<br>ulatior                   | al soil pressure<br>of soil bearing                     | e IS  | t'm<br>Fs<br>Solid Grouting<br>Modular Ratio 'n'  | psi =<br>psi =<br>=<br>=                                       |  |   |   |  |
|  |                                      |   |   | Wall Weight   | psf =  | 150.0                                    |   |   |  |

psf =

psi =

=

=

= ASD

psi = 60,000.0

Short Term Factor

Equiv. Solid Thick.

Concrete Data

f'c

Fy

Masonry Block Type

Masonry Design Method

= Medium Weight

2,500.0

Load Factors **Building Code** IBC 2018,ACI Dead Load 1.200 Live Load 1.600 Earth, H 1.600 Wind, W 1.000 Seismic, E 1.000

#4@ 15.87 in

#5@ 24.60 in

#6@ 34.92 in

This Wall in File: p:\studio ectypos\steinborn residence ectypos\calculations\retain schedule - site

| RetainPro (c) 1987-2019, Build 11.20.03.31<br>License : KW-06056595<br>License To : BYKONEN CARTER QU  | I<br>IINN   | Cantilevered R   | etaining Wa   | II Code: IBC 2018,ACI 318-14,TMS 402-16   |
|--|---|--|---|---|
| Concrete Stem Rebar Area D   | Details   |  |   |   |
| Bottom Stem<br>As (based on applied moment) :  | Vertical<br>0.2585 i  | Reinforcing<br>n2/ft   | Horizontal Reinfor  | rcing   |
| (4/3) * As :   | 0.3447 i  | n2/ft  | Min Stem T&S Re   | einf Area 2.736 in2   |
| 200bd/fy : 200(12)(10.1875)/60000 :  | 0.4075 i  | n2/ft  | Min Stem T&S Re   | einf Area per ft of stem Height : 0.288 in2/ft  |
| 0.0018bh : 0.0018(12)(12) :  | 0.2592 i  | n2/ft  | Horizontal Reinfor  | rcing Options :   |
|  | ======  | ======   | One layer of :  | Two layers of :   |
| Required Area :  | 0.3447 i  | n2/ft  | #4@ 8.33 in   | #4@ 16.67 in  |
| Provided Area :  | 0.465 in:   | 2/ft   | #5@ 12.92 in  | #5@ 25.83 in  |
| Maximum Area :   | 1.3801 i  | n2/ft  | #6@ 18.33 in  | #6@ 36.67 in  |
| Footing Data   |   | Footing Desig  | gn Results  |   |
| Toe Width=Heel Width=Total Footing Width=Footing Thickness=1Key Width=Key Depth=1Key Distance from Toef'c=2,500 psiFyFooting Concrete Density=15Min. As %=0.00Cover @ Top2.00@ Btm.= | 8.25 ft<br><u>1.00</u><br>9.25<br>4.00 in<br>0.00 in<br>6.00 in<br>0.00 ft<br>0.00 psi<br>0.00 pcf<br>0018<br>= 3.00 in | Factored Pressure<br>Mu' : Upward<br>Mu' : Downward<br>Mu: Design<br>Actual 1-Way Shear<br>Allow 1-Way Shear<br>Toe Reinforcing<br>Heel Reinforcing<br>Key Reinforcing<br>Footing Torsion, Tu<br>Footing Allow. Torsio | Toe<br>= 1,098<br>= 319,458<br>= 117,612<br>= 16,821<br>= 21.11<br>= 75.00<br>= # 5 @ 8.00 i<br>= # 5 @ 8.00 i<br>= # 4 @ 10.00<br>=<br>pon, phi Tu = | Heel<br>36 psf<br>0 ft-#<br>0 ft-#<br>0 ft-#<br>0.00 psi<br>0.00 psi<br>n<br>n<br>0.00 ft-lbs<br>0.00 ft-lbs                              |
|  |   | If torsion exceed  | ds allowable, pro   | ovide   |
|  |   | supplemental de  | esign for footing   | i torsion.  |
|  |   | Other Acceptable S<br>Toe: #4@ 5.71 in<br>Heel: #4@ 7.93 in<br>Key: #4@ 11.11  | 51Zes & Spacing<br>1, #5@ 8.85 in, #6<br>1, #5@ 12.30 in, #<br>in, #5@ 17.22 in,  | Js<br>፩@ 12.57 in, #7@ 17.14 in, #8@ 22.57 in, #9@ 28.<br>₺6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39<br>#6@ 18 in, #7@ 18 in, #8@ 1 |
|  |   | Min footing T&S re<br>Min footing T&S re<br>If one layer of hori   | einf Area<br>einf Area per foot<br>zontal bars:   | 2.80 in2<br>0.30 in2 <i>/</i> ft<br>If two layers of horizontal bars:   |

#4@ 7.94 in

#5@ 12.30 in

#6@ 17.46 in

| tetainPro (c) 1987-2019, Build 11.20.03.31<br>.icense : KW-06056595<br>.icense To : BYKONEN CARTER QUINN |              |                      | 4                           | Cantilevere    | d Retaining Wall   | Code: IBC 2018,ACI 318-14,TMS 402- |                                |                |  |  |
|--|--------------|----------------------|-----------------------------|----------------|--|------------------------------------|--------------------------------|----------------|--|--|
| Summary of Overturning & Resisting Forces & Moments  |              |                      |                             |                |  |                                    |                                |                |  |  |
| Item   | For<br>Ib    | <b>OV</b><br>ce<br>s | ERTURNING<br>Distance<br>ft | Moment<br>ft-# |  | RE<br>Force<br>Ibs                 | ESISTING<br>Distance<br>ft     | Moment<br>ft-# |  |  |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hydrostatic Force                            | ) 2,0<br>)   | 67.2                 | 3.39                        | 7,005.6        | Soil Over HL (ab. water tbl)<br>Soil Over HL (bel. water tbl)<br>Watre Table |                                    |                                |                |  |  |
| Buovant Force  | =            |                      |                             |                | Sloped Soil Over Heel =  |                                    |                                |                |  |  |
| Surcharge over Heel  | =            |                      |                             |                | Surcharge Over Heel =  |                                    |                                |                |  |  |
| Surcharge Over Toe   | =            |                      |                             |                | Adjacent Footing Load =  |                                    |                                |                |  |  |
| Adjacent Footing Load  | =            |                      |                             |                | Axial Dead Load on Stem =  |                                    |                                |                |  |  |
| Added Lateral Load   | =            |                      |                             |                | * Axial Live Load on Stem =  |                                    |                                |                |  |  |
| Load @ Stem Above Soil   | =            |                      |                             |                | Soil Over Toe =  | 536.3                              | 4.13                           | 2,212.0        |  |  |
| Seismic Earth Load   | = 6          | 51.2                 | 5.08                        | 3,310.1        | Surcharge Over Toe =   |                                    |                                |                |  |  |
|  | =            |                      |                             | ,              | Stem Weight(s) =   | 1,425.0                            | 8.75                           | 12,468.8       |  |  |
| Tatal  | 0.7          | 40.4                 |                             | 40.045.7       | Earth @ Stem Transitions =   |                                    |                                |                |  |  |
| Iotai  | = 2,7        | 18.4                 | 0.1.M. =                    | 10,315.7       | Footing Weight =   | 1,618.8                            | 4.63                           | 7,486.7        |  |  |
|  |              |                      |                             |                | Key Weight =   | 166.7                              | 0.42                           | 69.4           |  |  |
| Resisting/Overturning  | Ratio        |                      | =                           | 2.62           | Vert. Component =  | 514.9                              | 9.25                           | 4,762.7        |  |  |
| Vertical Loads used fo   | or Soil Pres | ssure                | = 3,746.                    | / Ibs          | Total =  | 4,261.6 l                          | bs <b>R.M.=</b>                | 26,999.7       |  |  |
| If seismic is included the   | OTM and      | l slidin             | a ratios                    |                | * Axial live load NOT included resistance, but is included for               | in total display<br>soil pressure  | ed, or used fo<br>calculation. | r overturning  |  |  |

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus 2 | 50.0 | pci |  |
|--------------------------------|------|-----|--|
|--------------------------------|------|-----|--|

Horizontal Defl @ Top of Wall (approximate only) 0.022 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

| RetainPro (c) 1987-2019, Buil   | d 11.20               | .03.31  |           | Cantilevered Poteini  | ing V   | Vall  |   |  |  |  |
|---|-----------------------|---|-----------|---|---|---|---|--|--|--|
| License : KW-06056595<br>License To : BYKONEN C   | ARTE                  |   | ,         |   | ng v  |   | Code: IBC 2018,ACI 318-14, IMS 402-1  |  |  |  |
| Criteria  |                       |   |           | Soil Data   |   |   |   |  |  |  |
| Retained Height<br>Wall height above soil<br>Slope Behind Wall<br>Height of Soil over Toe<br>Water height over heel | =<br>=<br>=           | 9.00 ft<br>0.50 ft<br>0.00<br>6.00 in<br>0.0 ft |           | Allow Soil Bearing = 4<br>Equivalent Fluid Pressure Methor<br>Active Heel Pressure =<br>Passive Pressure =<br>Soil Density, Heel =<br>Soil Density, Toe = | 4,000.0<br>d<br>40.0<br>300.0<br>130.00<br>130.00 | ) psf<br>) psf/ft<br>) psf/ft<br>) pcf<br>) pcf |   |  |  |  |
|   |                       |   |           | Soil height to ignore<br>for passive pressure =   | 0.00  | in  |   |  |  |  |
| Surcharge Loads   |                       |   |           | Lateral Load Applied to   | Stem  |   | Adjacent Footing Load   |  |  |  |
| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Over                      | & Ove<br>=<br>turninę | 0.0 psf<br>erturning<br>0.0<br>9                |           | Lateral Load =<br>Height to Top =<br>Height to Bottom =<br>Load Type = Win  | 0.0 #,<br>0.00 ft<br>0.00 ft<br>d (W)             | /ft   | Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ft |  |  |  |
| Axial Load Applied  | l to S                | tem   |           | (Ser  | vice Le   | evel)   | Footing Type Line Load<br>Base Above/Below Soil   |  |  |  |
| Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity   | =<br>=<br>=           | 0.0 lbs<br>0.0 lbs<br>0.0 in                    |           | Wind on Exposed Stem <sub>=</sub> (Service Level)   | 0.0 p   | sf  | at Back of Wall = 0.0 ft<br>Poisson's Ratio = 0.300   |  |  |  |
| Design Summary  |                       |   |           | Stem Construction   |   | Bottom  |   |  |  |  |
| Wall Stability Ratios<br>Overturning<br>Sliding   | =                     | 3.85 OK<br>1.58 OK                              |           | Design Height Above Ftg<br>Wall Material Above "Ht"<br>Design Method<br>Thickness<br>Rebar Size   | ft =<br>=<br>=<br>=                               | 0.00<br>Concrete<br>LRFD<br>12.00<br># 5        |   |  |  |  |
| Total Bearing Load<br>resultant ecc.  | =<br>=                | 3,747 lbs<br>6.72 in                            |           | Rebar Spacing<br>Rebar Placed at  | =   | 8.00<br>Edge                                    |   |  |  |  |
| Soil Pressure @ Toe<br>Soil Pressure @ Heel<br>Allowable<br>Soil Pressure Less                                      | =<br>=<br>=<br>s Thar | 552 psf<br>258 psf<br>4,000 psf<br>Allowable    | OK<br>OK  | Design Data<br>fb/FB + fa/Fa<br>Total Force @ Section<br>Service Level  | =<br>Ibs =  | 0.385   | i   |  |  |  |
| ACI Factored @ Toe<br>ACI Factored @ Heel   | =<br>=                | 773 psf<br>361 psf                              |           | Strength Level<br>MomentActual  | Ibs =   | 2,592.0   |   |  |  |  |
| Footing Shear @ Toe<br>Footing Shear @ Heel<br>Allowable  | =<br>=<br>=           | 17.3 psi<br>0.0 psi<br>75.0 psi                 | OK<br>OK  | Strength Level<br>MomentAllowable   | ft-# =<br>=                                       | 7,776.0<br>20,169.2                             |   |  |  |  |
| Lateral Sliding Force<br>less 100% Passive Force<br>less 100% Friction Force  | =<br>ce = -<br>e = -  | 2,067.2 lbs<br>1,350.0 lbs<br>1,917.7 lbs       |           | Service Level<br>Strength Level<br>ShearAllowable   | psi =<br>psi =<br>psi =                           | 21.2<br>75.0                                    |   |  |  |  |
| Added Force Req'dfor 1.5 Stability  | =<br>=                | 0.0 lbs<br>0.0 lbs                              | OK<br>OK  | Anet (Masonry)<br>Rebar Depth 'd'<br><b>Masonry Data</b>  | in2 =<br>in =                                     | 10.19   |   |  |  |  |
| Vertical component of activ<br>NOT considered in the calc   | re later<br>culatior  | al soil pressur<br>of soil bearin               | e IS<br>g | f'm<br>Fs<br>Solid Grouting<br>Modular Ratio 'n'<br>Wall Weiaht   | psi =<br>psi =<br>=<br>psf =                      | 150.0   |   |  |  |  |
| Load Factors<br>Building Code<br>Dead Load<br>Live Load   | IB                    | C 2018,ACI<br>1.200<br>1.600                    |           | Short Term Factor<br>Equiv. Solid Thick.<br>Masonry Block Type<br>Masonry Design Method   | =   | Medium V<br>ASD                                 | Veight  |  |  |  |
| ⊨arth, H<br>Wind, W<br>Seismic, E   |                       | 1.600<br>1.000<br>1.000                         |           | Concrete Data<br>f'c<br>Fy  | psi =<br>psi =                                    | 2,500.0<br>60,000.0                             |   |  |  |  |

#4@ 15.87 in

#5@ 24.60 in

#6@ 34.92 in

This Wall in File: p:\studio ectypos\steinborn residence ectypos\calculations\retain schedule - site

| RetainPro (c) 1987-2019, Build 11.20.03.3<br>License : KW-06056595<br>License To : BYKONEN CARTER QU   | IINN  | Cantilevered R   | etaining Wal  | Code: IBC 2018,ACI 318-14,TMS 402-16   |  |  |
|--|---|--|---|--|--|--|
| Concrete Stem Rebar Area   | Details   |  |   |  |  |  |
| Bottom Stem<br>As (based on applied moment) :  | Vertical<br>0.1751 i  | Reinforcing<br>n2/ft   | Horizontal Reinford   | sing   |  |  |
| (4/3) * As :   | 0.2335 i  | n2/ft  | Min Stem T&S Reinf Area 2.736 in2   |  |  |  |
| 200bd/fy : 200(12)(10.1875)/60000 :  | 0.4075 i  | n2/ft  | Min Stem T&S Rei  | nf Area per ft of stem Height : 0.288 in2/ft   |  |  |
| 0.0018bh : 0.0018(12)(12) :  | 0.2592 i  | n2/ft  | Horizontal Reinford   | cing Options :   |  |  |
|  | ======  | =====  | One layer of :  | Two layers of :  |  |  |
| Required Area :  | 0.2592 i  | n2/ft  | #4@ 8.33 in   | #4@ 16.67 in   |  |  |
| Provided Area :  | 0.465 in:   | 2/ft   | #5@ 12.92 in  | #5@ 25.83 in   |  |  |
| Maximum Area :   | 1.3801 i  | n2/ft  | #6@ 18.33 in  | #6@ 36.67 in   |  |  |
| Footing Data   |   | Footing Desi   | gn Results  |  |  |  |
| Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=1Key Depth=Key Distance from Toe=f'c=2,500 psiFyFooting Concrete Density=15Min. As %=0.00Cover @ Top2.00@ Btm.= | 8.25 ft<br><u>1.00</u><br>9.25<br>4.00 in<br>0.00 in<br>6.00 in<br>0.00 ft<br>0.00 psi<br>0.00 pcf<br>0018<br>= 3.00 in | Factored Pressure<br>Mu': Upward<br>Mu': Downward<br>Mu: Design<br>Actual 1-Way Shear<br>Toe Reinforcing<br>Heel Reinforcing<br>Key Reinforcing<br>Footing Torsion, Tu<br>Footing Allow. Torsi | Toe           =         773           =         265,657           =         117,612           =         12,337           r         =         17.25           =         75.00           =         # 5 @ 8.00 ir           =         # 5 @ 8.00 ir           =         # 4 @ 10.00           =         on, phi Tu | Heel<br>361 psf<br>0 ft-#<br>0 ft-#<br>0 ft-#<br>0.00 psi<br>0.00 psi<br>0.00 ft-lbs<br>0.00 ft-lbs                                    |  |  |
|  |   | If torsion excee   | ds allowable, pro   | vide   |  |  |
|  |   | supplemental d   | esign for footing   | torsion.   |  |  |
|  |   | Otner Acceptable<br>Toe: #4@ 6.68 in<br>Heel: #4@ 7.93 in<br>Key: #4@ 11.11  | Sizes & Spacings<br>n, #5@ 10.36 in, #6<br>n, #5@ 12.30 in, #6<br>in, #5@ 17.22 in, #   | s<br>6@ 14.70 in, #7@ 20.05 in, #8@ 26.40 in, #9@ 33<br>6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39<br>#6@ 18 in, #7@ 18 in, #8@ 1 |  |  |
|  |   | Min footing T&S r<br>Min footing T&S r<br>If one layer of hor  | einf Area<br>einf Area per foot<br>izontal bars:  | 2.80 in2<br>0.30 in2 /ft<br>If two layers of horizontal bars:  |  |  |

#4@ 7.94 in

#5@ 12.30 in

#6@ 17.46 in

| Summary of Overtu   | urning & R          | esisting F                   | orces & Mon            | nents   |                           |                           |                            |
|---|---------------------|------------------------------|------------------------|---|---------------------------|---------------------------|----------------------------|
| Item  | ON<br>Force<br>الbs | /ERTURNING<br>Distance<br>ft | Moment<br>ft-#         |   | RE<br>Force<br>Ibs        | SISTING<br>Distance<br>ft | Moment<br>ft-#             |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hydrostatic Force               | 2,067.2             | 3.39                         | 7,005.6                | Soil Over HL (ab. water tbl)<br>Soil Over HL (bel. water tbl)<br>Watre Table  | )                         |                           |                            |
| Buoyant Force =<br>Surcharge over Heel =<br>Surcharge Over Toe =<br>Adjacent Footing Load = | :                   |                              |                        | Sloped Soil Over Heel =<br>Surcharge Over Heel =<br>Adjacent Footing Load =<br>Axial Dead Load on Stem =<br>* Axial Live Load on Stem = |                           |                           |                            |
| Load @ Stem Above Soil =  | :                   |                              |                        | Soil Over Toe =<br>Surcharge Over Toe =   | 536.3                     | 4.13                      | 2,212.0                    |
| _   |                     |                              |                        | Stem Weight(s) =  | 1,425.0                   | 8.75                      | 12,468.8                   |
| Total =   | 2,067.2             | O.T.M. =                     | 7,005.6<br><b>3.85</b> | Footing Weight =<br>Key Weight =<br>Vert. Component =   | 1,618.8<br>166.7<br>514.9 | 4.63<br>0.42<br>9.25      | 7,486.7<br>69.4<br>4,762.7 |

<sup>t</sup> Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring  | Reactior  | n Modulu  | IS       |         |          |         | 250.0    | pci     |            |        |
|--------------|-----------|-----------|----------|---------|----------|---------|----------|---------|------------|--------|
| Horizontal E | Defl @ To | op of Wa  | all (app | roximat | e only)  | )       | 0.016    | in      |            |        |
| The above of | alculatic | on is not | valid if | the hee | l soil b | bearing | pressure | exceeds | that of th | e toe. |
|              |           |           |          |         |          |         | ·        |         |            |        |

| This Wall in File: p:\studio ectype  | os\steinborn resid  | ence ectypos\calculations\retain   | schedule - site  |  |
|--|---|--|--|--|
| RetainPro (c) 1987-2019, Build 11.2<br>License : KW-06056595<br>License To : BYKONEN CARTI                       | 0.03.31<br>ER QUINN   | Cantilevered Retain  | ning Wall  | Code: IBC 2018,ACI 318-14,TMS 402-16   |
| Criteria   |   | Soil Data  |  |  |
| Retained Height=Wall height above soil=Slope Behind Wall=  | 10.00 ft<br>0.50 ft<br>0.00                                     | Allow Soil Bearing =<br>Equivalent Fluid Pressure Meth<br>Active Heel Pressure =   | 5,332.0 psf<br>nod<br>40.0 psf/ft                            |  |
| Height of Soil over Toe =<br>Water height over heel =  | 6.00 in<br>0.0 ft   | = Passive Pressure =<br>Soil Density, Heel =<br>Soil Density, Toe =<br>Footing  Soil Friction =<br>Soil height to ignore<br>for passive pressure = | 300.0 psf/ft<br>130.00 pcf<br>130.00 pcf<br>0.450<br>0.00 in |  |
| Surcharge Loads  |   | Lateral Load Applied to  | o Stem   | Adjacent Footing Load  |
| Surcharge Over Heel =<br>Used To Resist Sliding & Ov<br>Surcharge Over Toe =<br>Used for Sliding & Overturnin    | 0.0 psf<br>verturning<br>0.0<br>ng                              | Lateral Load =<br>Height to Top =<br>Height to Bottom =<br>Load Type = W   | 0.0 #/ft<br>0.00 ft<br>0.00 ft<br>ind (W)                    | Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine Load |
| Axial Dead Load =<br>Axial Live Load =<br>Axial Load Eccentricity =  | 0.0 lbs<br>0.0 lbs<br>0.0 in                                    | (S<br>Wind on Exposed Stem <sub>=</sub><br>(Service Level)   | ervice Level)<br>0.0 psf                                     | Base Above/Below Soil<br>at Back of Wall = 0.0 ft<br>Poisson's Ratio = 0.300   |
| Earth Pressure Seism   | ic Load   |  |  |  |
| Method:Uniform<br>Multiplier Used =<br>(Multiplier used on soil densit   | 9.000<br>y)   | Uniform Seismic Force = 10<br>Total Seismic Force = 1,12   | 02.000<br>56.000   |  |
| Design Summary   |   | Stem Construction  | Bottom<br>Stem C   | ĸ  |
| Wall Stability RatiosOverturningSliding=Total Baseign Load   | 2.82 OK<br>1.20 Ratio   | <ul> <li>Design Height Above F</li> <li>Wall Material Above "H</li> <li>Design Method</li> <li>Thickness</li> <li>Rebar Size</li> </ul>            | ttg ft = 0.0<br>tt" = Concre<br>= LRF<br>= 12.0<br>= #       | 0<br>te<br>D<br>0<br>6   |
| resultant ecc. =   | 4,679 lbs<br>19.31 in   | Rebar Spacing<br>Rebar Placed at   | = 10.0<br>= Edg  | le   |
| Soil Pressure @ Toe =<br>Soil Pressure @ Heel =<br>Allowable =<br>Soil Pressure Less Tha<br>ACI Factored @ Toe = | 773 psf C<br>59 psf C<br>5,332 psf<br>in Allowable<br>1,082 psf | K fb/FB + fa/Fa<br>K Total Force @ Section<br>Service Level<br>Strength Level  | = 0.73<br>n<br>lbs =<br>lbs = 4,220                          | 37<br>0  |
| ACI Factored @ Heel=Footing Shear @ Toe=Footing Shear @ Heel=Allowable=  | 83 psf<br>20.2 psi C<br>0.0 psi C<br>75.0 psi                   | K Service Level<br>K Strength Level<br>MomentAllowable   | ft-# =<br>ft-# = 15,766<br>= 21,388.                         | .7<br>7  |
| Sliding Calcs<br>Lateral Sliding Force =<br>less 100% Passive Force =<br>less 100% Friction Force =              | 3,378.1 lbs<br>- 1,666.7 lbs<br>- 2,393.4 lbs                   | ShearActual<br>Service Level<br>Strength Level<br>ShearAllowable   | psi =<br>psi = 36<br>psi = 75.                               | 5<br>0   |
| Added Force Req'd =<br>for 1.5 Stability =   | 0.0 lbs C<br>1,007.1 lbs N                                      | K Anet (Masonry)<br>IG Rebar Depth 'd'<br>Masonry Data   | in2 =<br>in = 9.6  | 3  |

Fs

f'c

Fy

Solid Grouting

Wall Weight

Concrete Data

Modular Ratio 'n'

Short Term Factor

Equiv. Solid Thick.

Masonry Block Type

Masonry Design Method

psi=

psf =

psi =

=

=

=

=

= ASD

psi = 60,000.0

150.0

= Medium Weight

2,500.0

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

| Load Factors  |              |
|---------------|--------------|
| Building Code | IBC 2018,ACI |
| Dead Load     | 1.200        |
| Live Load     | 1.600        |
| Earth, H      | 1.600        |
| Wind, W       | 1.000        |
| Seismic, E    | 1.000        |
|               |              |

#5@ 21.53 in

#6@ 30.56 in

This Wall in File: p:\studio ectypos\steinborn residence ectypos\calculations\retain schedule - site

| RetainPro (c) 1987-2019, Build 11.20.03.3<br>License : KW-06056595<br>License To : BYKONEN CARTER QU  | Cantilever   | ed Retaining Wall  | Code: IBC 2018,ACI 318-14,TMS 402-16   |
|---|--|--|--|
| Concrete Stem Rebar Area  | Details  |  |  |
| Bottom Stem<br>As (based on applied moment) :   | Vertical Reinforcing<br>0.3765 in2/ft  | Horizontal Reinforcing   |  |
| (4/3) * As :  | 0.502 in2/ft   | Min Stem T&S Reinf Area  | a 3.024 in2  |
| 200bd/fy : 200(12)(9.625)/60000 :   | 0.385 in2/ft   | Min Stem T&S Reinf Area  | a per ft of stem Height : 0.288 in2/ft   |
| 0.0018bh : 0.0018(12)(12) :   | 0.2592 in2/ft  | Horizontal Reinforcing Op  | ptions :   |
|   |  | One layer of : Two la  | ayers of :   |
| Required Area :   | 0.385 in2/ft   | #4@ 8.33 in #4@  | 16.67 in   |
| Provided Area :   | 0.528 in2/ft   | #5@ 12.92 in #5@   | 25.83 in   |
| Maximum Area :  | 1.3039 in2/ft  | #6@ 18.33 in #6@   | 36.67 in   |
| Footing Data  | Footing  | Design Results   |  |
| Toe Width=1Heel Width=Total Footing Width=1Footing Thickness=1Key Width=1Key Depth=1Key Distance from Toe=f'c= $2,500 \text{ psi}$ Fy =60Footing Concrete Density=15Min. As %= $0.0$ Cover @ Top $2.00$ @ Btm.= | 0.25 ft<br>1.00 Factored Press<br>1.25 Mu': Upward<br>6.00 in Mu': Downwa<br>Mu: Design<br>0.00 in Actual 1-Way<br>8.00 in Allow 1-Way<br>0.00 ft Toe Reinforcir<br>0.00 pcf Key Reinforcir<br>0.00 pcf Key Reinforcir<br>0.018 Footing Torsio<br>= 3.00 in Footing Allow. | $\begin{array}{cccccccccccccccccccccccccccccccccccc$   | el<br>33 psf<br>0 ft:#<br>0 ft:#<br>0 ft:#<br>00 psi<br>00 psi<br>00 psi<br>00 ft-lbs<br>.00 ft-lbs                |
|   | If torsion of supplement   | exceeds allowable, provide   | n  |
|   | Other Accept   |  |  |
|   | Toe: #4@<br>Heel: #4@<br>Key: #4@  | 4.80 in, #5@ 7.43 in, #6@ 10.5<br>6.94 in, #5@ 10.76 in, #6@ 15.<br>11.11 in, #5@ 17.22 in, #6@ 15 | i6 in, #7@ 14.39 in, #8@ 18.96 in, #9@ 24.<br>.27 in, #7@ 20.83 in, #8@ 27.43 in, #9@ 34<br>8 in, #7@ 18 in, #8@ 1 |
|   | Min footing<br>Min footing<br>If one layer<br>#4@ 6.94   | T&S reinf Area3.8T&S reinf Area per foot0.3of horizontal bars:If two4 in#40                        | 39 in2<br>35 in2 <i>I</i> ft<br>Iayers of horizontal bars:<br>@ 13.89 in   |

#5@ 10.76 in

#6@ 15.28 in

| Summary of Overturning & Resisting Forces & Moments  |                               |                              |                      |   |                    |                            |                     |  |  |
|--|-------------------------------|------------------------------|----------------------|---|--------------------|----------------------------|---------------------|--|--|
| Item   | Force<br>Ibs                  | /ERTURNING<br>Distance<br>ft | Moment<br>ft-#       |   | RE<br>Force<br>Ibs | ESISTING<br>Distance<br>ft | Moment<br>ft-#      |  |  |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hydrostatic Force<br>Buoyant Force =<br>Surcharge over Heel<br>Surcharge Over Toe<br>Adjacent Footing Load =<br>Added Lateral Load | 2,568.9<br>=<br>=<br>=<br>=   | 3.78                         | 9,704.7              | Soil Over HL (ab. water tbl)<br>Soil Over HL (bel. water tbl)<br>Watre Table<br>Sloped Soil Over Heel =<br>Surcharge Over Heel =<br>Adjacent Footing Load =<br>Axial Dead Load on Stem =<br>* Axial Live Load on Stem = |                    |                            |                     |  |  |
| Load @ Stem Above Soil =<br>Seismic Earth Load =<br>:  | =<br>= 809.2<br>=             | 5.67                         | 4,585.5              | Soil Over Toe =<br>Surcharge Over Toe =<br>Stem Weight(s) =   | 666.3<br>1,575.0   | 5.13<br>10.75              | 3,414.5<br>16,931.3 |  |  |
| Total :  | = 3,378.1                     | 0.T.M. =                     | 14,290.2             | Footing Weight =  | 2,250.0<br>187.5   | 5.63<br>0.42               | 12,656.3<br>78.1    |  |  |
| Resisting/Overturning<br>Vertical Loads used for   | <b>Ratio</b><br>Soil Pressure | =<br>= 4,678.8               | <b>2.82</b><br>3 lbs | Vert. Component =<br>Total =  | 639.8<br>5,318.6   | 11.25<br>bs <b>R.M.=</b>   | 7,198.2             |  |  |

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus | 250.0 pci |
|------------------------------|-----------|
|------------------------------|-----------|

Horizontal Defl @ Top of Wall (approximate only) 0.020 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

| This Wall in File: p:\studio e  | ctypos                | s\steinborn resi  | den      | ce ectypos\calculations\retain so   | chedule  | e - site   |  |
|---|-----------------------|---|----------|---|--|--|--|
| RetainPro (c) 1987-2019, Build<br>License : KW-06056595<br>License To : BYKONEN C   | d 11.20<br>ARTE       | 0.03.31<br>R QUINN  |          | Cantilevered Retain   | ing V  | Vall   | Code: IBC 2018,ACI 318-14,TMS 402-16   |
| Criteria  |                       |   |          | Soil Data   |  |  |  |
| Retained Height<br>Wall height above soil<br>Slope Behind Wall<br>Height of Soil over Toe<br>Water height over heel   | =<br>=<br>=           | 10.00 ft<br>0.50 ft<br>0.00<br>6.00 in<br>0.0 ft                      |          | Allow Soil Bearing = 4<br>Equivalent Fluid Pressure Metho<br>Active Heel Pressure =<br>Passive Pressure =<br>Soil Density, Heel =<br>Soil Density, Toe =<br>Footing  Soil Friction =<br>Soil height to ignore<br>for passive pressure = | 4,000.0<br>d<br>40.0<br>300.0<br>130.00<br>0.450<br>0.00 | ) psf<br>) psf/ft<br>) psf/ft<br>) pcf<br>) pcf<br>)<br>in |  |
| Surcharge Loads   |                       |   |          | Lateral Load Applied to   | Stem   |  | Adjacent Footing Load  |
| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Over<br>Axial Load Applied<br>Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity | E Ove                 | 0.0 psf<br>erturning<br>0.0<br>g<br><b>Stem</b><br>0.0 lbs<br>0.0 lbs |          | Lateral Load =<br>Height to Top =<br>Height to Bottom =<br>Load Type = Win<br>(Ser<br>Wind on Exposed Stem =<br>(Service Level)   | 0.0 #<br>0.00 ft<br>0.00 ft<br>d (W)<br>rvice L<br>0.0 p | /ft<br>evel)<br>sf   | Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine LoadBase Above/Below Soil<br>at Back of Wall=0.0 ftPoisson's Ratio=0.300 |
|   | =                     | 0.0 111   |          | Stom Construction   | _  | Bottom   |  |
| Design Summary  |                       |   |          | Stem Construction   |  | Stem OK  |  |
| Wall Stability Ratios<br>Overturning<br>Sliding   | =<br>=                | 4.15 OK<br>1.58 OK  |          | Design Height Above Ftg<br>Wall Material Above "Ht"<br>Design Method<br>Thickness<br>Rebar Size   | ft =<br>=<br>=<br>=                                      | 0.00<br>Concrete<br>LRFD<br>12.00<br># 6                   |  |
| Total Bearing Loadresultant ecc.  | =<br>=                | 4,679 lbs<br>7.55 in  |          | Rebar Spacing<br>Rebar Placed at  | =  | 10.00<br>Edge  |  |
| Soil Pressure @ Toe<br>Soil Pressure @ Heel<br>Allowable<br>Soil Pressure Les   | =<br>=<br>=<br>s Thar | 555 psf<br>276 psf<br>4,000 psf<br>Allowable                          | OK<br>OK | fb/FB + fa/Fa<br>Total Force @ Section<br>Service Level   | =<br>Ibs =   | 0.498  | 3  |
| ACI Factored @ Toe<br>ACI Factored @ Heel   | =<br>=                | 778 psf<br>387 psf  |          | Strength Level<br>MomentActual  | lbs =  | 3,200.0  |  |
| Footing Shear @ Toe<br>Footing Shear @ Heel<br>Allowable  | =<br>=<br>=           | 16.8 psi<br>0.0 psi<br>75.0 psi                                       | OK<br>OK | Strength Level<br>MomentAllowable   | ft-# =<br>=  | 10,666.7<br>21,388.7                                       | ,  |
| Sliding Calcs<br>Lateral Sliding Force<br>less 100% Passive Forc<br>less 100% Friction Forc   | =<br>ce = -<br>e = -  | 2,568.9 lbs<br>1,666.7 lbs<br>2,393.4 lbs                             |          | ShearActual<br>Service Level<br>Strength Level<br>ShearAllowable  | psi =<br>psi =<br>psi =                                  | 27.7<br>75.0   |  |
| Added Force Req'dfor 1.5 Stability  | =                     | 0.0 lbs<br>0.0 lbs  | OK<br>OK | Anet (Masonry)<br>Rebar Depth 'd'<br><b>Masonry Data</b>  | in2 =<br>in =  | 9.63   |  |
| Vertical component of activ<br>NOT considered in the calc   | ve later<br>culation  | ral soil pressure<br>n of soil bearing                                | e IS     | t'm<br>Fs<br>Solid Grouting<br>Modular Ratio 'n'<br>Wall Weight<br>Short Torm Factor  | psi =<br>psi =<br>=<br>psf =                             | 150.0  |  |
| Building Code<br>Dead Load<br>Live Load<br>Earth, H   | IB                    | C 2018,ACI<br>1.200<br>1.600<br>1.600                                 |          | Equiv. Solid Thick.<br>Masonry Block Type<br>Masonry Design Method  | =<br>=<br>=  | Medium V<br>ASD  | Veight   |
| Wind, W<br>Seismic, E   |                       | 1.000<br>1.000  |          | f'c<br>Fy   | psi =<br>psi =   | 2,500.0<br>60,000.0  |  |

#4@ 13.89 in

#5@ 21.53 in

#6@ 30.56 in

This Wall in File: p:\studio ectypos\steinborn residence ectypos\calculations\retain schedule - site

| RetainPro (c) 1987-2019, Build 11.20.<br>License : KW-06056595<br>License To : BYKONEN CARTER   | QUINN Cant  | levered Retair  | ning Wall   | Code: IBC 2018,ACI 318-14,TMS 402-16  |
|---|---|---|---|---|
| Concrete Stem Rebar Are   | a Details   |   |   |   |
| Bottom Stem<br>As (based on applied moment) :   | Vertical Reinforc<br>0.2547 in2/ft  | ing Horizo  | ontal Reinforci   | ing   |
| (4/3) * As :  | 0.3396 in2/ft   | Min St  | tem T&S Rein  | of Area 3.024 in2   |
| 200bd/fy: 200(12)(9.625)/60000:   | 0.385 in2/ft  | Min St  | tem T&S Rein  | nf Area per ft of stem Height : 0.288 in2/ft  |
| 0.0018bh : 0.0018(12)(12) :   | 0.2592 in2/ft   | Horizo  | ntal Reinforci  | ing Options :   |
|   |   | One la  | ayer of : T   | Two layers of :   |
| Required Area :   | 0.3396 in2/ft   | #4@   | 8.33 in 🛛 🕯   | #4@ 16.67 in  |
| Provided Area :   | 0.528 in2/ft  | #5@ 1   | 2.92 in   | #5@ 25.83 in  |
| Maximum Area :  | 1.3039 in2/ft   | #6@ 1   | 18.33 in  | #6@ 36.67 in  |
| Footing Data  | Fc  | oting Design R  | esults  |   |
| Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Depth=Key Distance from Toe=f'c=2,500 psiFyFooting Concrete Density=Min. As %=Cover @ Top2.00@ B | 10.25 ft         Factor           1.00         Factor           11.25         Mu':           16.00 in         Mu':           10.00 in         Actual           18.00 in         Allow           0.00 ft         Toe F           60,000 psi         Heel           150.00 pcf         Key F           0.0018         Footin           tm.=         3.00 in | red Pressure =<br>Jpward =<br>Downward =<br>Design =<br>I 1-Way Shear =<br>1-Way Shear =<br>einforcing = #<br>Reinforcing = #<br>g Torsion, Tu<br>g Allow. Torsion, phi | Toe<br>778<br>415,364<br>200,459<br>17,909<br>16.80<br>75.00<br>€ 6 @ 10.56 ir<br>€ 4 @ 10.00 ir<br>=<br>i Tu = | Heel<br>387 psf<br>0 ft-#<br>0 ft-#<br>0.00 psi<br>0.00 psi<br>0.00 ft-lbs<br>0.00 ft-lbs                                       |
|   | lf <sup>•</sup>   | orsion exceeds allo   | owable, prov  | ide   |
|   | SL  | pplemental design   | for footing to  | orsion.   |
|   | Other<br>Too<br>He<br>Key   | Acceptable Sizes<br>e: #4@ 5.50 in, #5@<br>el: #4@ 6.94 in, #5@<br>r: #4@ 11.11 in, #5  | & Spacings<br>8 8.53 in, #6@<br>9 10.76 in, #6<br>@ 17.22 in, #6  | 0 12.12 in, #7@ 16.52 in, #8@ 21.76 in, #9@ 27.<br>@ 15.27 in, #7@ 20.83 in, #8@ 27.43 in, #9@ 34<br>6@ 18 in, #7@ 18 in, #8@ 1 |
|   | Mir<br>Min<br>If o  | footing T&S reinf Ar<br>footing T&S reinf Ar<br>he layer of horizontal  | ea<br>ea per foot<br>bars:  | 3.89 in2<br>0.35 in2 <i>f</i> t<br>If two layers of horizontal bars:  |

#4@ 6.94 in

#5@ 10.76 in

#6@ 15.28 in

| Summary of Overturning & Resisting Forces & Moments  |                  |                              |                        |  |                             |                           |                           |                             |  |
|--|------------------|------------------------------|------------------------|--|-----------------------------|---------------------------|---------------------------|-----------------------------|--|
| ltem   | Force<br>Ibs     | /ERTURNING<br>Distance<br>ft | Moment<br>ft-#         | _  |                             | RE<br>Force<br>Ibs        | SISTING<br>Distance<br>ft | Moment<br>ft-#              |  |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hydrostatic Force  | 2,568.9          | 3.78                         | 9,704.7                | Soil Over HL (ab. water<br>Soil Over HL (bel. wate<br>Watre Table  | <sup>.</sup> tbl)<br>r tbl) |                           |                           |                             |  |
| Juoyant Force       =         Surcharge over Heel       =         Surcharge Over Toe       =         Adjacent Footing Load       = | :<br>:<br>:<br>: |                              |                        | Sloped Soil Over Heel<br>Surcharge Over Heel<br>Adjacent Footing Load<br>Axial Dead Load on Ste<br>* Axial Live Load on Sten | =<br>=<br>m=<br>n =         |                           |                           |                             |  |
| _oad @ Stem Above Soil =   | =                |                              |                        | Soil Over Toe<br>Surcharge Over Toe  | =                           | 666.3                     | 5.13                      | 3,414.5                     |  |
|  |                  |                              |                        | Stem Weight(s)   | =                           | 1,575.0                   | 10.75                     | 16,931.3                    |  |
| Total =  | = 2,568.9        | O.T.M. =                     | 9,704.7<br><b>4.15</b> | Footing Weight<br>Key Weight   | =                           | 2,250.0<br>187.5<br>639.8 | 5.63<br>0.42<br>11.25     | 12,656.3<br>78.1<br>7 198 2 |  |

\* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus                                    | 250.0    | рсі                      |
|---|----------|--------------------------|
| Horizontal Defl @ Top of Wall (approximate only)                | 0.014    | in                       |
| The above calculation is not valid if the heel soil bearing pre | essure e | exceeds that of the toe, |
| because the wall would then tend to rotate into the retained    | soil.    |                          |

| This Wall in File: p:\studio e  | ctypos\steinborn reside   | nce ectypos\calculations\retain so  | hedule - site  |  |
|---|---|---|--|--|
| RetainPro (c) 1987-2019, Build<br>License : KW-06056595<br>License To : BYKONEN CA  | 11.20.03.31<br>ARTER QUINN  | Cantilevered Retain   | ng Wall  | Code: IBC 2018,ACI 318-14,TMS 402-16   |
| Criteria  |   | Soil Data   |  |  |
| Retained Height<br>Wall height above soil<br>Slope Behind Wall<br>Height of Soil over Toe<br>Water height over heel         | = 7.00 ft<br>= 0.50 ft<br>= 0.00<br>= 6.00 in<br>= 0.0 ft                               | Allow Soil Bearing = 4<br>Equivalent Fluid Pressure Metho<br>Active Heel Pressure =<br>Passive Pressure =<br>Soil Density, Heel =<br>Soil Density, Toe =<br>Footing  Soil Friction =<br>Soil height to ignore<br>for passive pressure = | ,000.0 psf<br>d<br>40.0 psf/ft<br>300.0 psf/ft<br>130.00 pcf<br>130.00 pcf<br>0.450<br>0.00 in |  |
| Surcharge Loads   |   | Lateral Load Applied to   | Stem   | Adjacent Footing Load  |
| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Over<br>Axial Load Applied        | = 0.0 psf<br>& Overturning<br>= 0.0<br>turning  | Lateral Load =<br>Height to Top =<br>Height to Bottom =<br>Load Type = Win  | 0.0 #/ft<br>0.00 ft<br>0.00 ft<br>d (W)  | Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine Load |
| Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity   | = 0.0 lbs<br>= 0.0 lbs<br>= 0.0 in  | Wind on Exposed Stem <sub>=</sub><br>(Service Level)  | 0.0 psf  | Base Above/Below Soil<br>at Back of Wall=0.0 ftPoisson's Ratio=0.300   |
| Design Summary  |   | Stem Construction   | Bottom   |  |
| Wall Stability Ratios<br>Overturning<br>Sliding   | = 3.41 OK<br>= 1.51 OK  | Design Height Above Ftg<br>Wall Material Above "Ht"<br>Design Method<br>Thickness   | Stem OK<br>ft = 0.00<br>= Concrete<br>= LRFD<br>= 12.00  |  |
| Total Bearing Loadresultant ecc.  | = 2,735 lbs<br>= 4.83 in  | Rebar Size<br>Rebar Spacing<br>Rebar Placed at  | = # 5<br>= 12.00<br>= Edge   |  |
| Soil Pressure @ Toe<br>Soil Pressure @ Heel<br>Allowable<br>Soil Pressure Less<br>ACI Factored @ Toe<br>ACI Factored @ Heel | = 241 psf OK<br>= 565 psf OK<br>= 4,000 psf<br>Than Allowable<br>= 337 psf<br>= 791 psf | Design Data<br>fb/FB + fa/Fa<br>Total Force @ Section<br>Service Level<br>Strength Level<br>MomentActual  | = <b>0.267</b><br>lbs =<br>lbs = 1,568.0   |  |
| Footing Shear @ Toe<br>Footing Shear @ Heel<br>Allowable  | = 9.1 psi OK<br>= 0.0 psi OK<br>= 75.0 psi  | Service Level<br>Strength Level<br>MomentAllowable  | ft-# =<br>ft-# = 3,658.7<br>= 13,701.3   |  |
| Sliding Calcs<br>Lateral Sliding Force<br>less 100% Passive Forc<br>less 100% Friction Force                                | = 1,280.0 lbs<br>e = - 704.2 lbs<br>e = - 1,231.0 lbs                                   | ShearAllowable  | psi =<br>psi = 12.8<br>psi = 75.0  |  |
| for 1.5 Stability   | = 0.0 lbs OK  | Rebar Depth 'd'<br>Masonry Data<br>f'm  | in = 10.19<br>psi =  |  |
| Vertical component of active considered in the calculation  | e lateral soil pressure IS<br>n of soil bearing pressu                                  | Solid Grouting<br>res. Modular Ratio 'n'<br>Wall Weight   | =<br>=<br>psf = 150.0  |  |
| Load Factors<br>Building Code<br>Dead Load<br>Live Load   | IBC 2018,ACI<br>1.200<br>1.600  | Short Term Factor<br>Equiv. Solid Thick.<br>Masonry Block Type<br>Masonry Design Method   | =<br>=<br>= Medium V<br>= ASD  | Veight   |
| Wind, W<br>Seismic, E   | 1.000<br>1.000<br>1.000   | Concrete Data<br>f'c<br>Fy  | psi = 2,500.0<br>psi = 60,000.0  |  |

#4@ 18.52 in

#5@ 28.70 in

#6@ 40.74 in

This Wall in File: p:\studio ectypos\steinborn residence ectypos\calculations\retain schedule - site

| RetainPro (c) 1987-2019, Build 11.20.03.<br>License : KW-06056595<br>License To : BYKONEN CARTER Q   | <sup>31</sup> (<br>UINN  | Cantilevered Re   | etaining V  | Vall  | Code: IBC 2018,ACI 318-14,TMS 402-16  |
|--|--|---|---|---|---|
| Concrete Stem Rebar Area   | Details  |   |   |   |   |
| Bottom Stem<br>As (based on applied moment) :  | Vertical Re<br>0.0824 in2  | einforcing ⊢<br>/ft   | lorizontal Rei  | nforcing  |   |
| (4/3) * As :   | 0.1098 in2   | /ft N   | /lin Stem T&S   | Reinf Area 2  | .160 in2  |
| 200bd/fy : 200(12)(10.1875)/60000 :  | 0.4075 in2   | /ft N   | /lin Stem T&S   | Reinf Area p  | er ft of stem Height : 0.288 in2/ft   |
| 0.0018bh : 0.0018(12)(12) :  | 0.2592 in2   | /ft ⊦   | lorizontal Rei  | nforcing Optic  | ins :   |
|  |  | ==== C  | One layer of :  | Two laye  | rs of :   |
| Required Area :  | 0.2592 in2   | /ft #   | 4@ 8.33 in  | #4@ 16.   | 67 in   |
| Provided Area :  | 0.31 in2/ft  | #   | 5@ 12.92 in   | #5@ 25  | .83 in  |
| Maximum Area :   | 1.3801 in2   | /ft #   | 6@ 18.33 in   | #6@ 36  | .67 in  |
| Footing Data   |  | Footing Desig   | n Results   |   |   |
| Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Depth=Key Distance from Toe=f'c=2,500 psiFyFooting Concrete Density=Min. As %=0Cover @ Top2.00@ Btm | 5.00 ft<br>1.00<br>6.00<br>12.00 in<br>8.00 in<br>8.00 in<br>0.00 ft<br>0,000 psi<br>50.00 pcf<br>.0018<br>= 3.00 in | Factored Pressure<br>Mu': Upward<br>Mu': Downward<br>Mu: Design<br>Actual 1-Way Shear<br>Allow 1-Way Shear<br>Toe Reinforcing<br>Heel Reinforcing<br>Key Reinforcing<br>Footing Torsion, Tu<br>Footing Allow. Torsion | Toe<br>= 333<br>= 69,463<br>= 38,700<br>= 2,564<br>= 9.00<br>= 75.00<br>= #5 @ 12<br>= #5 @ 12<br>= #4 @ 13<br>=<br>n, phi Tu = | Heel           7         791             7         0 1           0         0 1           4         0 f           6         0.00             2.00 in | osf<br>it-#<br>it-#<br>osi<br>osi<br>ft-Ibs<br>ft-Ibs   |
|  |  | If torsion exceed   | ls allowable,   | provide   |   |
|  |  | supplemental de   | sign for foot   | ing torsion.  |   |
|  |  | Other Acceptable S<br>Toe: #4@ 9.25 in,<br>Heel: #4@ 9.25 in,<br>Key: #4@ 13.88 in<br>Min footing T&S re  | izes & Spac<br>#5@ 14.35 ii<br>#5@ 14.35 ii<br>n, #5@ 18 in,<br>inf Area  | n, #6@ 20.37<br>n, #6@ 20.37<br>#6@ 18 in, #<br>1.56  | in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46<br>in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46<br>7@ 18 in, #8@ 18 i<br>in2 |
|  |  | Min footing T&S rei   | inf Area per fo<br>contal bars:   | oot 0.26<br>If two lay  | in2 /ft<br>/ers of horizontal bars:   |

#4@ 9.26 in

#5@ 14.35 in

#6@ 20.37 in

| License : KW-06056595<br>License To : BYKONEN CARTER QUINN  |                     |                              | Cantilevere            | d Retaining Wall  | Code: IBC 20           | 18,ACI 318-               | 14,TMS 402-                |
|---|---------------------|------------------------------|------------------------|---|------------------------|---------------------------|----------------------------|
| Summary of Overtu   | urning & R          | esisting F                   | orces & Mon            | nents   |                        |                           |                            |
| Item  | O\<br>Force<br>الbs | /ERTURNING<br>Distance<br>ft | Moment<br>ft-#         |   | RE<br>Force<br>Ibs     | SISTING<br>Distance<br>ft | Moment<br>ft-#             |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hydrostatic Force                                       | 1,280.0             | 2.67                         | 3,413.3                | Soil Over HL (ab. water tbl)<br>Soil Over HL (bel. water tbl)<br>Watre Table  | )                      |                           |                            |
| Buoyant Force =<br>Surcharge over Heel =<br>Surcharge Over Toe =<br>Adjacent Footing Load =<br>Added Lateral Load = |                     |                              |                        | Sloped Soil Over Heel =<br>Surcharge Over Heel =<br>Adjacent Footing Load =<br>Axial Dead Load on Stem =<br>* Axial Live Load on Stem = |                        |                           |                            |
| Load @ Stem Above Soil =  |                     |                              |                        | Soil Over Toe =<br>Surcharge Over Toe =   | 325.0                  | 2.50                      | 812.5                      |
| _   |                     |                              |                        | Stem Weight(s) =  | 1,125.0                | 5.50                      | 6,187.5                    |
| Total =   | 1,280.0             | O.T.M. =                     | 3,413.3<br><b>3.41</b> | Footing Weight =<br>Key Weight =  | 900.0<br>66.7<br>318 8 | 3.00<br>0.33<br>6.00      | 2,700.0<br>22.2<br>1 912 9 |
| Vertical Loads used for   | Soil Pressure       | = 2,735.                     | 5 lbs                  |   | = 2,735.5 l            | bs <b>R.M.=</b>           | 11,635.1                   |

<sup>t</sup> Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus                                    | 250.0    | рсі                     |
|---|----------|-------------------------|
| Horizontal Defl @ Top of Wall (approximate only)                | 0.014    | in                      |
| The above calculation is not valid if the heel soil bearing pre | essure e | xceeds that of the toe, |
| because the wall would then tend to rotate into the retained    | soil.    |                         |

~ .. . - 1 . . . . . . . . ... . .. . ,

| RetainPro (c) 1987-2019, Build<br>License : KW-06056595<br>License To : BYKONEN C                                   | a 11.20<br>ARTE      | D.03.31<br>R QUINN                    |                            | Cantilevered Retain  | ing V                                  | Vall                          | Code: IBC 2018,A  | CI 318-14,TMS 402-16  |
|---|----------------------|---------------------------------------|----------------------------|--|--|-------------------------------|---|---|
| Criteria  |                      |                                       | So                         | il Data  |  |                               |   |   |
| Retained Height<br>Wall height above soil<br>Slope Behind Wall<br>Height of Soil over Toe<br>Water beight over beel | =<br>=<br>=          | 7.00 ft<br>0.50 ft<br>0.00<br>6.00 in | Allo<br>Equ<br>Acti<br>Pas | w Soil Bearing = =<br>ivalent Fluid Pressure Metho<br>ve Heel Pressure =<br>=<br>sive Pressure = | 5,332.0<br>od<br>40.0<br>300.0         | ) psf<br>) psf/ft<br>) psf/ft |   |   |
|   | _                    | 0.0 K                                 | Soil<br>Soil<br>Foo        | Density, Heel =<br>Density, Toe =<br>ting  Soil Friction =                                       | 130.00<br>130.00<br>0.450              | ) pcf<br>) pcf<br>)           |   |   |
|   |                      |                                       | Soil                       | r passive pressure =   | 0.00                                   | in                            |   | <b>••</b>   |
| Surcharge Loads   |                      |                                       | La                         | teral Load Applied to  | Stem                                   | <b>n</b>                      | Adjacent Footing  | Load  |
| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Over                      | e<br>& Ove<br>turnin | 0.0 psf<br>erturning<br>0.0<br>g      | Late<br>H<br>H             | eral Load =<br>eight to Top =<br>eight to Bottom =<br>d Type = Wir                               | 0.0 #,<br>0.00 ft<br>0.00 ft<br>nd (W) | /ft                           | Adjacent Footing Load<br>Footing Width<br>Eccentricity<br>Wall to Ftg CL Dist<br>Footing Type | = 0.0 lbs<br>= 0.00 ft<br>= 0.00 in<br>= 0.00 ft<br>Line Load |
|   |                      |                                       |                            | (Se  | rvice L                                | evel)                         | Base Above/Below Soil   | = 0.0 ft  |
| Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity   | =<br>=<br>=          | 0.0 lbs<br>0.0 lbs<br>0.0 in          | Wi<br>(S                   | nd on Exposed Stem <sub>=</sub><br>ervice Level)   | 0.0 p                                  | sf                            | at Back of Wall<br>Poisson's Ratio  | = 0.300   |
| Earth Pressure Se   | ismi                 | c Load                                |                            |  |  |                               |   |   |
| Method : Uniform<br>Multiplier Used<br>(Multiplier used on soil d   | =<br>ensity          | 9.000<br>')                           | Uni<br>Tot                 | form Seismic Force = 73<br>al Seismic Force = 600  | 3.500<br>0.250                         |                               |   |   |
| Design Summary  |                      |                                       | S                          | tem Construction   |  | Bottom                        |   |   |
|   |                      |                                       |                            | Design Height Above Ft   | ft =                                   | Stem OF<br>0.00               |   |   |
| Wall Stability Ratios   | =                    | 2.20 0                                |                            | Wall Material Above "Ht  | ' =                                    | Concrete                      | •   |   |
| Sliding   | _                    | 2.28 C                                | n.<br>atio < 1.5!          | Design Method  | =                                      | LRFD                          |   |   |
| Chang   |                      |                                       |                            | Rebar Size   | =                                      | 12.00                         |   |   |
| Total Bearing Load  | =                    | 2,567 lbs                             | 6                          | Rebar Spacing  | =                                      | 12.00                         |   |   |
| resultant ecc.  | =                    | 13.44 in                              |                            | Rebar Placed at  | =                                      | Edge                          | •   |   |
| Soil Pressure @ Toe   | =                    | 910 ps                                | f OK                       | fb/EB + fa/Ea  | _                                      | 0 39                          | 8   |   |
| Soil Pressure @ Heel  | =                    | 0 ps                                  | f OK                       | Total Force @ Section  | _                                      | 0.000                         |   |   |
| Allowable   | =                    | 5,332 ps                              | f                          | Service Level  | lbs =                                  |                               |   |   |
| Soil Pressure Less  | s Thar               | 1 Allowable                           | f                          | Strength Level   | lbs =                                  | 2.082.5                       |   |   |
| ACI Factored @ Heel   | =                    | 1,274 ps<br>0 ps                      | f                          | MomentActual   |  | _,                            |   |   |
| Footing Shear @ Toe   | =                    | 16.2 ps                               | i OK                       | Service Level  | ft-# =                                 |                               |   |   |
| Footing Shear @ Heel  | =                    | 0.0 ps                                | i OK                       | Strength Level   | ft-# =                                 | 5,459.4                       | Ļ   |   |
| Allowable   | =                    | ,<br>75.0 ps                          | i                          | MomentAllowable  | =                                      | 13,701.3                      | 1   |   |
| Sliding Calcs   |                      |                                       |                            | ShearActual  |  |                               |   |   |
| Lateral Sliding Force   | =                    | 1,754.1 lbs                           | 6                          | Service Level  | psi =                                  |                               |   |   |
| less 100% Passive Ford  | ;e = -               | 816.7 lbs                             | 5                          | Strength Level   | psi =                                  | 17.0                          | )   |   |
| iess 100% Friction Force  | e = -                | 1,304.5 lbs                           | 8                          | ShearAllowable   | psi =                                  | 75.0                          |   |   |
| Added Force Req'd   | =                    | 0.0 lbs                               | S OK                       | Anet (Masonry)   | in2 =                                  |                               |   |   |
| for 1.5 Stability   | =                    | 509.9 lb                              | s NG                       | Rebar Depth 'd'<br>Masonry Data  | in =                                   | 10.19                         | )   |   |
|   |                      |                                       |                            | ťm<br>Fe   | psi =                                  |                               |   |   |
|   |                      |                                       |                            | FS   | psi =                                  |                               |   |   |

Solid Grouting

Wall Weight

Concrete Data

f'c

Fy

Modular Ratio 'n'

Short Term Factor

Equiv. Solid Thick.

Masonry Block Type

Masonry Design Method

=

=

=

=

= ASD

psi = 60,000.0

psf =

psi =

150.0

= Medium Weight

2,500.0

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

| Load Factors  |              |
|---------------|--------------|
| Building Code | IBC 2018,ACI |
| Dead Load     | 1.200        |
| Live Load     | 1.600        |
| Earth, H      | 1.600        |
| Wind, W       | 1.000        |
| Seismic, E    | 1.000        |
|               |              |

| RetainPro (c) 1987-2019, Build 11.20.03.31<br>License : KW-06056595<br>License To : BYKONEN CARTER QUIN   | Cantilevered   | d Retaining Wall   | Code: IBC 2018,ACI 318-14,TMS 402-16  |
|---|--|--|---|
| Concrete Stem Rebar Area De   | tails  |  |   |
| Bottom Stem<br>As (based on applied moment) :   | Vertical Reinforcing<br>0.1229 in2/ft  | Horizontal Reinforcing   |   |
| (4/3) * As :  | 0.1639 in2/ft  | Min Stem T&S Reinf Area  | a 2.160 in2   |
| 200bd/fy : 200(12)(10.1875)/60000 :   | 0.4075 in2/ft  | Min Stem T&S Reinf Area  | a per ft of stem Height : 0.288 in2/ft  |
| 0.0018bh : 0.0018(12)(12) :   | 0.2592 in2/ft  | Horizontal Reinforcing Op  | tions :   |
|   |  | One layer of : Two lay   | yers of :   |
| Required Area :   | 0.2592 in2/ft  | #4@ 8.33 in #4@ 1  | 6.67 in   |
| Provided Area :   | 0.31 in2/ft  | #5@ 12.92 in #5@ 2   | 25.83 in  |
| Maximum Area :  | 1.3801 in2/ft  | #6@ 18.33 in #6@ 3   | 36.67 in  |
| Footing Data  | Footing D  | esign Results  |   |
| Toe Width=5.Heel Width= $1.$ Total Footing Width=6.Footing Thickness=14.Key Width=8.1Key Depth=8.1Key Distance from Toe=0.1f'c =2,500 psiFy =60,00Footing Concrete Density=150.Min. As %=0.00Cover @ Top2.00@ Btm.= | 00 ft       00         00       Mu': Upward         00 in       Mu': Downward         00 in       Mu: Design         00 in       Actual 1-Way SI         00 in       Allow 1-Way SI         00 in       Allow 1-Way SI         00 ft       Toe Reinforcing         00 psi       Heel Reinforcing         00 pcf       Key Reinforcing         18       Footing Torsion,         3.00 in       Footing Allow. T | $\begin{array}{cccccccccccccccccccccccccccccccccccc$   | 1<br>0 psf<br>0 ft-#<br>0 ft-#<br>0 psi<br>0 psi<br>0 psi<br>0 psi<br>00 ft-lbs<br>00 ft-lbs                    |
|   | If torsion ex  | ceeds allowable, provide   |   |
|   | supplement   | al design for footing torsion  | 1.  |
|   | Other Acceptat<br>Toe: #4@ 7.<br>Heel: #4@ 7.<br>Key: #4@ 13   | Die Sizes & Spacings<br>93 in, #5@ 12.30 in, #6@ 17.4<br>93 in, #5@ 12.30 in, #6@ 17.4<br>3.88 in, #5@ 18 in, #6@ 18 in, | 46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39<br>46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39<br>, #7@ 18 in, #8@ 18 i |
|   | Min footing T&<br>Min footing T&<br>If one layer of  | S reinf Area 1.8<br>Freinf Area per foot 0.3<br>Norizontal bars: If two  | 1 in2<br>0 in2 <i>I</i> ft<br>layers of horizontal bars:  |

- #4@ 7.94 in #5@ 12.30 in #6@ 17.46 in
- 0.30 In2 /it If two layers of hc #4@ 15.87 in #5@ 24.60 in #6@ 34.92 in

| Summary of Overturning & Resisting Forces & Moments  |  |                                       |                      |  |  |                                |                  |
|--|--|---------------------------------------|----------------------|--|--|--------------------------------|------------------|
| Item   | Force<br>Ibs   | DVERTURNING<br>Distance<br>ft         | Moment<br>ft-#       |  | RE<br>Force<br>Ibs   | SISTING<br>Distance<br>ft      | Moment<br>ft-#   |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hydrostatic Force<br>Buoyant Force<br>Surcharge over Heel<br>Surcharge Over Toe<br>Adjacent Footing Load<br>Added Lateral Load<br>Load @ Stem Above Soil<br>Seismic Earth Load | 1,333.<br>=<br>=<br>=<br>=<br>=<br>=<br>=<br>=<br>=<br>=<br>420. | <ul><li>2.72</li><li>2.4.08</li></ul> | 3,631.1              | Soil Over HL (ab. water th<br>Soil Over HL (bel. water th<br>Watre Table<br>Sloped Soil Over Heel<br>Surcharge Over Heel<br>Adjacent Footing Load<br>Axial Dead Load on Stem<br>* Axial Live Load on Stem<br>Soil Over Toe<br>Surcharge Over Toe<br>Stem Weight(s) | bl)<br>=<br>=<br>=<br>=<br>=<br>=<br>=<br>325.0<br>=<br>=<br>1,125.0 | 2.50<br>5.50                   | 812.5<br>6,187.5 |
| Total  | = 1,754.   | 1 <b>O.T.M.</b> =                     | 5,346.9              | Earth @ Stem Transitions<br>Footing Weight   | =<br>= 1,050.0   | 3.00                           | 3,150.0          |
| Resisting/Overturning<br>Vertical Loads used for   | Ratio<br>Soil Pressu   | =<br>e = 2,566.                       | <b>2.28</b><br>7 lbs | Key Weight<br>Vert. Component  | = 66.7<br>= 332.2<br>= 2.808.0                                       | 0.33<br>6.00<br>bs <b>PM -</b> | 22.2<br>1,993.4  |

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

#### Tilt

#### Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus | 250.0 pci |
|------------------------------|-----------|
|------------------------------|-----------|

Horizontal Defl @ Top of Wall (approximate only) 0.032 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,
Seismic, E

1.000

Fy

psi = 60,000.0

| This Wall in File: p:\studio e  | ctypos\steinborn resig   | ence ectypos\calculations\retain sc  | :hedule  | e - site  |  |  |
|---|--|--|--|---|--|--|
| RetainPro (c) 1987-2019, Buil<br>License : KW-06056595<br>License To : BYKONEN C  | d 11.20.03.31<br>ARTER QUINN   | Cantilevered Retaini   | ng V   | Vall  | Code: IBC 2018,A   | CI 318-14,TMS 402-16   |
| Criteria  |  | Soil Data  |  |   |  |  |
| Retained Height<br>Wall height above soil<br>Slope Behind Wall<br>Height of Soil over Toe<br>Water height over heel   | = 6.00 ft<br>= 0.50 ft<br>= 0.00<br>= 6.00 in<br>= 0.0 ft  | Allow Soil Bearing       =       4         Equivalent Fluid Pressure Metho       Active Heel Pressure       =         Active Heel Pressure       =       =         Passive Pressure       =       =         Soil Density, Heel       =       =         Soil Density, Toe       =       =         Footing  Soil Friction       =       =         Soil height to ignore       for passive pressure       = | k,000.0<br>d<br>300.0<br>130.00<br>130.00<br>0.450<br>0.00 | psf<br>psf/ft<br>pcf<br>pcf                                       | •  |  |
| Surcharge Loads   |  | Lateral Load Applied to  | Stem   |   | Adjacent Footing I   | Load   |
| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Over<br>Axial Load Applied<br>Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity           | = 0.0 psf<br>& Overturning<br>= 0.0<br>rturning<br>d to Stem<br>= 0.0 lbs<br>= 0.0 lbs<br>= 0.0 in                                 | Lateral Load =<br>Height to Top =<br>Height to Bottom =<br>Load Type = Win<br>(Ser<br>Wind on Exposed Stem =<br>(Service Level)  | 0.0 #/<br>0.00 ft<br>0.00 ft<br>d (W)<br>vice Le<br>0.0 p: | /ft<br>evel)<br>sf  | Adjacent Footing Load<br>Footing Width<br>Eccentricity<br>Wall to Ftg CL Dist<br>Footing Type<br>Base Above/Below Soil<br>at Back of Wall<br>Poisson's Ratio | = 0.0 lbs<br>= 0.00 ft<br>= 0.00 in<br>= 0.00 ft<br>Line Load<br>= 0.0 ft<br>= 0.300 |
| Design Summary  |  | Stem Construction  |  | Bottom  |  |  |
| Wall Stability Ratios<br>Overturning<br>Sliding<br>Total Bearing Load<br>resultant ecc.<br>Soil Pressure @ Toe<br>Soil Pressure @ Heel<br>Allowable<br>Soil Pressure Less<br>ACI Factored @ Toe | = 3.44 OK<br>= 1.90 OK<br>= 2,032 lbs<br>= 6.26 in<br>= 727 psf (<br>= 143 psf (<br>= 4,000 psf<br>s Than Allowable<br>= 1,018 psf | Design Height Above Ftg         Wall Material Above "Ht"         Design Method         Thickness         Rebar Size         Rebar Spacing         Rebar Placed at         Design Data         fb/FB + fa/Fa         Total Force @ Section         Strength Level         Moment_Actual   | ft =<br>=<br>=<br>=<br>=<br>Ibs =                          | 0.00<br>Concrete<br>LRFD<br>8.00<br># 4<br>12.00<br>Edge<br>0.425 | ,<br>,<br>,<br>,<br>,  |  |
| Footing Shear @ Toe<br>Footing Shear @ Heel<br>Allowable<br>Sliding Calcs<br>Lateral Sliding Force<br>less 100% Passive Forc<br>less 100% Friction Forc   | = 201 psi<br>= 10.2 psi C<br>= 7.9 psi C<br>= 75.0 psi<br>= 1,027.2 lbs<br>ce = - 816.7 lbs<br>ce = - 1,135.6 lbs                  | K Service Level<br>K Strength Level<br>MomentAllowable<br>ShearActual<br>Service Level<br>Strength Level<br>ShearAllowable   | ft-# =<br>ft-# =<br>psi =<br>psi =<br>psi =                | 2,304.0<br>5,412.6<br>15.4<br>75.0                                | )  |  |
| Added Force Req'd<br>for 1.5 Stability  | = 0.0 lbs C<br>= 0.0 lbs C   | K Anet (Masonry)<br>K Rebar Depth 'd'<br>Masonry Data<br>f'm   | in2 =<br>in =<br>psi =                                     | 6.25  |  |  |
| Vertical component of activ<br>NOT considered in the calc   | /e lateral soil pressure<br>culation of soil bearing   | IS Solid Grouting<br>Modular Ratio 'n'<br>Wall Weight<br>Short Term Factor   | psi =<br>=<br>=<br>psf =                                   | 100.0   |  |  |
| Building Code<br>Dead Load<br>Live Load<br>Earth, H   | IBC 2018,ACI<br>1.200<br>1.600<br>1.600  | Equiv. Solid Thick.<br>Masonry Block Type<br>Masonry Design Method<br>Concrete Data  | =<br>=<br>=  | Medium V<br>ASD   | Veight   |  |
| Wind, W   | 1.000  | f'c  | psi =  | 2,500.0   |  |  |

#4@ 15.87 in

#5@ 24.60 in

#6@ 34.92 in

This Wall in File: p:\studio ectypos\steinborn residence ectypos\calculations\retain schedule - site

| RetainPro (c) 1987-2019, Build 11.20.0<br>License : KW-06056595<br>License To : BYKONEN CARTER   | 3.31<br>QUINN   | Cantilevered Re  | etaini                                   | ng Wal   | I (   | Code: IBC 2018,ACI 318-14,TMS 402-16   |
|--|---|--|--|--|---|--|
| Concrete Stem Rebar Area   | a Details   |  |  |  |   |  |
| Bottom Stem<br>As (based on applied moment) :  | Vertical F<br>0.0863 in   | Reinforcing H<br>2/ft  | Horizont                                 | al Reinford  | cing  |  |
| (4/3) * As :   | 0.1151 in   | 2/ft N   | Min Sten                                 | n T&S Rei  | nf Area 1.2   | 248 in2  |
| 200bd/fy: 200(12)(6.25)/60000:   | 0.25 in2/f  | t N  | Min Sten                                 | n T&S Rei  | inf Area pe   | r ft of stem Height : 0.192 in2/ft   |
| 0.0018bh : 0.0018(12)(8) :   | 0.1728 in   | 2/ft ⊦   | Horizont                                 | al Reinford  | cing Optior   | IS :   |
|  | ======  | ===== (  | One laye                                 | er of :  | Two layers  | s of :   |
| Required Area :  | 0.1728 in   | 2/ft #   | #4@ 12.                                  | 50 in  | #4@ 25.0  | 00 in  |
| Provided Area :  | 0.2 in2/ft  | #  | <i>‡</i> 5@ 19.                          | 38 in  | #5@ 38.7  | 75 in  |
| Maximum Area :   | 0.8467 in   | 2/ft #   | #6@ 27.                                  | 50 in  | #6@ 55.0  | 00 in  |
| Footing Data   |   | Footing Desig  | yn Res                                   | sults  |   |  |
| Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Depth=Key Distance from Toe=f'c=2,500 psiFyFooting Concrete Density=Min. As %=Cover @ Top2.00@ Bt | 3.67 ft<br>1.00<br>4.67<br>14.00 in<br>8.00 in<br>8.00 in<br>0.00 ft<br>60,000 psi<br>150.00 pcf<br>0.0018<br>m.= 3.00 in | Factored Pressure<br>Mu' : Upward<br>Mu' : Downward<br>Mu: Design<br>Actual 1-Way Shear<br>Allow 1-Way Shear<br>Toe Reinforcing<br>Heel Reinforcing<br>Key Reinforcing<br>Footing Torsion, Tu<br>Footing Allow. Torsio | = (<br>= ;<br>=<br>= #5<br>= #5<br>= Nor | Toe<br>1,018<br>64,874<br>23,236<br>3,470<br>10.19<br>75.00<br>@ 12.00 i<br>@ 12.00 i<br>me Spec'd<br>=<br>u = | Heel<br>201 p<br>12 ft<br>326 ft<br>314 ft<br>7.91 p<br>75.00 p<br>in<br>in<br>0.00 | sf<br>#<br>-#<br>si<br>si<br>ft-lbs<br>ft-lbs                                  |
|  |   | If torsion exceed  | ds allow                                 | able, prov   | vide<br>torsion   |  |
|  |   | Other Acceptable S   | Sizes &                                  | Spacing  | 3   |  |
|  |   | Toe: #4@ 7.93 in<br>Heel: #4@ 7.93 in<br>Key: phiMn = phi  | , #5@ 1<br>, #5@ 1<br>5'lambd            | 2.30 in, #6<br>2.30 in, #6<br>a'sqrt(fc)'\$  | 5@ 17.46 i<br>6@ 17.46 i<br>6m  | n, #7@ 23.80 in, #8@ 31.34 in, #9@ 39<br>n, #7@ 23.80 in, #8@ 31.34 in, #9@ 39 |
|  |   | Min footing T&S re<br>Min footing T&S re<br>If one layer of horiz  | einf Area<br>inf Area<br>zontal ba       | i<br>per foot<br>ars:  | 1.41<br>0.30<br>If two laye   | in2<br>in2 <i>/</i> ft<br>ers of horizontal bars:                              |

#4@ 7.94 in

#5@ 12.30 in

#6@ 17.46 in

| RetainPro (c) 1987-2019, Build 1<br>License : KW-06056595<br>License To : BYKONEN CAR       | 1.20.03.31<br>RTER QUINI    | N                            | Cantilevere          | d Retaining Wall  | Code: IBC 20                           | 18,ACI 318-               | 14,TMS 402-1       |
|---|-----------------------------|------------------------------|----------------------|---|--|---------------------------|--------------------|
| Summary of Overtu   | rning & R                   | esisting F                   | orces & Mon          | nents   |  |                           |                    |
| ltem  | Force<br>Ibs                | /ERTURNING<br>Distance<br>ft | G<br>Moment<br>ft-#  |   | RE<br>Force<br>Ibs                     | SISTING<br>Distance<br>ft | Moment<br>ft-#     |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hydrostatic Force               | 1,027.2                     | 2.39                         | 2,453.9              | Soil Over HL (ab. water tbl)<br>Soil Over HL (bel. water tbl)<br>Watre Table  | 260.0                                  | 4.50<br>4.50              | 1,170.1<br>1,170.1 |
| Buoyant Force =<br>Surcharge over Heel =<br>Surcharge Over Toe =<br>Adjacent Footing Load = |                             |                              |                      | Sloped Soil Over Heel =<br>Surcharge Over Heel =<br>Adjacent Footing Load =<br>Axial Dead Load on Stem =<br>* Axial Live Load on Stem = |  |                           |                    |
| Load @ Stem Above Soil =  |                             |                              |                      | Soil Over Toe =<br>Surcharge Over Toe =   | 238.4                                  | 1.83                      | 437.0              |
|   |                             |                              |                      | Stem Weight(s) =<br>Earth @ Stem Transitions=   | 650.0                                  | 4.00                      | 2,600.2            |
| Total =   | 1,027.2                     | O.T.M. =                     | 2,453.9              | Footing Weight =<br>Key Weight =  | 816.7<br>66.7                          | 2.33<br>0.33              | 1,905.8<br>22.2    |
| Resisting/Overturning Ra<br>Vertical Loads used for Se                                      | t <b>io</b><br>oil Pressure | =<br>= 2,031                 | <b>3.44</b><br>7 lbs | Vert. Component =<br>Total =<br>* Axial live load NOT included  | 491.8<br>2,523.6  <br>in total display | 4.67<br>bs <b>R.M.=</b>   | 2,295.4<br>8,430.8 |

<sup>6</sup> Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

# Tilt

# Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus                                    | 250.0    | pci                      |
|---|----------|--------------------------|
| Horizontal Defl @ Top of Wall (approximate only)                | 0.028    | in                       |
| The above calculation is not valid if the heel soil bearing pre | essure e | exceeds that of the toe, |

because the wall would then tend to rotate into the retained soil.

~ ... - 1 . . . . . . . .. ..... , .

| RetainPro (C) 1987-2019, Build<br>License : KW-06056595<br>License To : BYKONEN CA                       | ARTER QUINN  | С   | antilevered Retain  | ning V  | Vall                                  | Code: IBC 2018,A  | CI 318-14,TMS 402-16                             |
|--|--|---|---|---|---------------------------------------|---|--|
| Criteria   |  | Soil  | Data  |   |                                       |   |  |
| Retained Height=Wall height above soil=Slope Behind Wall=Height of Soil over Toe=Water height over heel= | = 6.00 ft<br>= 0.50 ft<br>= 0.00<br>= 6.00 in<br>= 0.0 ft              | Allow<br>Equiv<br>Active<br>Passi<br>Soil E<br>Soil E<br>Footin | Soil Bearing =<br>alent Fluid Pressure Meth<br>e Heel Pressure =<br>ve Pressure =<br>Density, Heel =<br>Density, Toe =<br>ng  Soil Friction = | 5,332.0<br>od<br>300.0<br>130.00<br>130.00<br>0.450 | psf<br>psf/ft<br>psf/ft<br>pcf<br>pcf |   |  |
|  |  | for   | passive pressure =  | 0.00  | in                                    |   | ••••   |
| Surcharge Loads  |  | Lat   | eral Load Applied to  | Stem  |                                       | Adjacent Footing  | Load   |
| Surcharge Over Heel<br>Used To Resist Sliding &<br>Surcharge Over Toe<br>Used for Sliding & Overth       | = 0.0 psf<br>& Overturning<br>= 0.0<br>urning                          | Later<br>He<br>He<br>Load                                       | al Load =<br>ght to Top =<br>ght to Bottom =<br>Type = W  | 0.0 #/<br>0.00 ft<br>0.00 ft<br>ind (W)             | ft                                    | Adjacent Footing Load<br>Footing Width<br>Eccentricity<br>Wall to Ftg CL Dist | = 0.0 lbs<br>= 0.00 ft<br>= 0.00 in<br>= 0.00 ft |
| Axial Load Applied   | to Stem  |   | (S  | ervice Le   | evel)                                 | Base Above/Below Soil   | Line Load  |
| Axial Dead Load =<br>Axial Live Load =<br>Axial Load Eccentricity =                                      | = 0.0 lbs<br>= 0.0 lbs<br>= 0.0 in                                     | Wind<br>(Se   | d on Exposed Stem <sub>=</sub><br>rvice Level)  | 0.0 ps  | sf                                    | at Back of Wall<br>Poisson's Ratio  | = 0.0 ft<br>= 0.300                              |
| Earth Pressure Sei   | smic Load  |   |   |   |                                       |   |  |
| Method : Uniform<br>Multiplier Used =<br>(Multiplier used on soil de                                     | = 9.000<br>ensity)   | Unifo<br>Total  | rm Seismic Force = 4<br>Seismic Force = 4   | 64.500<br>62.250                                    | Bottom                                |   |  |
| Design Summary   |  |   | Design Usight Above 5   | —   | Stem Ok                               |   |  |
| Wall Stability Ratios<br>Overturning<br>Sliding  | = 2.11 OK<br>= 1.39 Rati   | 0 < 1.5!  | Wall Material Above "H<br>Design Method<br>Thickness  | tg π =<br>t" =<br>=                                 | Concrete<br>LRFD<br>8.00              |   |  |
| Total Bearing Load   | = 1,873 lbs  |   | Rebar Size<br>Rebar Spacing   | =   | # c<br>12.00                          |   |  |
| resultant ecc.   | = 15.52 in   |   | Rebar Placed at   | =   | Edge                                  |   |  |
| Soil Pressure @ Toe<br>Soil Pressure @ Heel<br>Allowable<br>Soil Pressure Less<br>ACI Factored @ Toe     | = 1,304 psf<br>= 0 psf<br>= 5,332 psf<br>Than Allowable<br>= 1,826 psf | OK<br>OK  | fb/FB + fa/Fa<br>Total Force @ Section<br>Service Level<br>Strength Level<br>MomentActual   | =<br>lbs =<br>lbs =                                 | <b>0.426</b><br>1,539.0               | 1   |  |
| Footing Shear @ Toe  | = 0 psr<br>= 13.8 psi  | OK  | Service Level   | ft-# =  |                                       |   |  |
| Footing Shear @ Heel   | = 7.1 psi  | OK  | Strength Level<br>MomentAllowable   | ft-# =<br>=   | 3,465.0<br>8,121.3                    | )   |  |
| Sliding Calcs<br>Lateral Sliding Force<br>less 100% Passive Force<br>less 100% Friction Force            | = 1,350.8  lbs<br>= - 816.7 lbs<br>= - 1,064.0 lbs                     |   | ShearActual<br>Service Level<br>Strength Level<br>ShearAllowable  | psi =<br>psi =<br>psi =                             | 20.7<br>75.0                          |   |  |
| Added Force Req'dfor 1.5 Stability   | = 0.0 lbs<br>= 145.5 lbs   | ok<br>Ng  | Anet (Masonry)<br>Rebar Depth 'd'   | in2 =<br>in =                                       | 6.19                                  |   |  |
|  |  |   | f'm<br>Fs   | psi =<br>psi =                                      |                                       |   |  |

Solid Grouting

Wall Weight

Concrete Data

f'c

Fy

Modular Ratio 'n'

Short Term Factor

Equiv. Solid Thick.

Masonry Block Type

Masonry Design Method

=

=

=

=

= ASD

psi = 60,000.0

psf =

psi =

100.0

= Medium Weight

2,500.0

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

| Load Factors  |              |
|---------------|--------------|
| Building Code | IBC 2018,ACI |
| Dead Load     | 1.200        |
| Live Load     | 1.600        |
| Earth, H      | 1.600        |
| Wind, W       | 1.000        |
| Seismic, E    | 1.000        |
|               |              |

| RetainPro (c) 1987-2019, Build 11.20.03.31<br>License : KW-06056595<br>License To : BYKONEN CARTER QUINN   | Cantilevered   | d Retaining Wall  | Code: IBC 2018,ACI 318-14,TMS 402-16   |
|--|--|---|--|
| Concrete Stem Rebar Area Det   | ails   |   |  |
| Bottom Stem<br>As (based on applied moment) :  | Vertical Reinforcing<br>0.1312 in2/ft  | Horizontal Reinforcing  |  |
| (4/3) * As :   | 0.1749 in2/ft  | Min Stem T&S Reinf Are  | a 1.248 in2  |
| 200bd/fy : 200(12)(6.1875)/60000 :   | 0.2475 in2/ft  | Min Stem T&S Reinf Area   | a per ft of stem Height : 0.192 in2/ft   |
| 0.0018bh : 0.0018(12)(8) :   | 0.1728 in2/ft  | Horizontal Reinforcing O  | ptions :   |
|  |  | One laver of : Two la   | avers of :   |
| Required Area :  | 0.1749 in2/ft  | #4@ 12.50 in #4@  | 25.00 in   |
| Provided Area :  | 0.31 in2/ft  | #5@ 19.38 in #5@  | 38.75 in   |
| Maximum Area :   | 0.8382 in2/ft  | #6@ 27.50 in #6@  | 55.00 in   |
| Footing Data   | Footing D  | esign Results   |  |
| Toe Width= $3.6$ Heel Width= $0.8$ Total Footing Width= $4.5$ Footing Thickness= $14.0$ Key Width= $8.0$ Key Depth= $8.0$ Key Distance from Toe= $0.0$ f'c = $2,500$ psiFy = $60,000$ Footing Concrete Density = $150.0$ Min. As %= $0.0013$ Cover @ Top $2.00$ @ Btm= 3 | 7 ft<br>3 Factored Pressu<br>0 Mu': Upward<br>0 in Mu': Downward<br>0 in Actual 1-Way Sh<br>0 in Actual 1-Way Sh<br>0 ft Toe Reinforcing<br>0 psi Heel Reinforcing<br>0 pcf Key Reinforcing<br>3 Footing Torsion,<br>.00 in Footing Allow. To<br>1f torsion ex-<br>supplementa | $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | el<br>0 psf<br>0 ft-#<br>47 ft-#<br>47 ft-#<br>09 psi<br>00 psi<br>0.00 ft-lbs<br>0.00 ft-lbs<br>0.00 ft-lbs |
|  | Other Acceptab<br>Toe: #4@ 7.5<br>Heel: #4@ 7.5<br>Key: phiMn =<br>Min footing T8<br>Min footing T8  | ble Sizes & Spacings           93 in, #5@ 12.30 in, #6@ 17.           93 in, #5@ 12.30 in, #6@ 17.           = phi'5'lambda'sqrt(fc)'Sm           & S reinf Area           2.5 reinf Area           0.7 | .46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39<br>.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39<br>36 in2           |

If one layer of horizontal bars:

#4@ 7.94 in

#5@ 12.30 in

#6@ 17.46 in

If two layers of horizontal bars:

#4@ 15.87 in

#5@ 24.60 in

#6@ 34.92 in

| RetainPro (c) 1987-2019, Bu<br>License : KW-06056595<br>License To : BYKONEN   | uild 11<br>CAR         | 1.20.03.31<br>TER QUINN     | N                           | Cantilevere         | d Retaining Wall   | Code: IBC 20                                      | 18,ACI 318-′   | 14,TMS 402-16                       |  |
|--|------------------------|-----------------------------|-----------------------------|---------------------|--|---|--|-------------------------------------|--|
| Summary of Overturning & Resisting Forces & Moments  |                        |                             |                             |                     |  |   |  |                                     |  |
| Item   |                        | Force<br>Ibs                | ERTURNING<br>Distance<br>ft | G<br>Moment<br>ft-# |  | RE<br>Force<br>Ibs                                | SISTING<br>Distance<br>ft                                    | Moment<br>ft-#                      |  |
| HL Act Pres (ab water tbl<br>HL Act Pres (be water tbl<br>Hydrostatic Force<br>Buoyant Force<br>Surcharge over Heel<br>Surcharge Over Toe<br>Adjacent Footing Load | ))<br>=<br>=<br>=<br>= | 1,027.2                     | 2.39                        | 2,453.9             | Soil Over HL (ab. water tbl)<br>Soil Over HL (bel. water tbl)<br>Watre Table<br>Sloped Soil Over Heel =<br>Surcharge Over Heel =<br>Adjacent Footing Load =<br>Axial Dead Load on Stem = | 130.0   | 4.42<br>4.42   | 574.2<br>574.2                      |  |
| Load @ Stem Above Soi<br>Seismic Earth Load  | -<br>=<br>=            | 323.6                       | 3.58                        | 1,159.5             | Soil Over Toe =<br>Surcharge Over Toe =<br>Stem Weight(s) =  | 238.4<br>650.0                                    | 1.83<br>4.00   | 437.0<br>2,600.2                    |  |
| Total  | =                      | 1,350.8                     | O.T.M. =                    | 3,613.4             | Footing Weight =<br>Key Weight =   | 787.6<br>66.7                                     | 2.25<br>0.33   | 1,772.1<br>22.2                     |  |
| Vertical Loads used for  |                        | il Pressure<br>M and slidir | = 1,872                     | .6 lbs              | * Axial live load NOT included<br>resistance, but is included for  | 2,364.4 II<br>in total display<br>r soil pressure | 4.50 _<br>bs <b>R.M.=</b><br>ed, or used for<br>calculation. | 7,619.2<br>7,019.2<br>r overturning |  |

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

# Tilt

# Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus | 250.0 | pci |
|------------------------------|-------|-----|
|                              |       |     |

Horizontal Defl @ Top of Wall (approximate only) 0.052 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

| RetainPro (c) 1987-2019, Build<br>License : KW-06056595<br>License To : BYKONEN CA             | d 11.20.0<br>ARTER           | 3.31<br>QUINN                       |                  | Cantilevered Retaini  | ing V                                      | Vall                             | Code: IBC 2018,ACI 318-14,TMS 402-1   |
|--|------------------------------|-------------------------------------|------------------|---|--|----------------------------------|---|
| Criteria   |                              |                                     |                  | Soil Data   |  |                                  |   |
| Retained Height<br>Wall height above soil<br>Slope Behind Wall                                 | = (                          | 5.00 ft<br>0.50 ft<br>0.00          | A<br>E<br>A      | Allow Soil Bearing = 4<br>Equivalent Fluid Pressure Methor<br>Active Heel Pressure =  | 4,000.0<br>d<br>40.0                       | ) psf<br>) psf/ft                |   |
| Height of Soil over Toe<br>Water height over heel  | = (                          | 5.00 in<br>0.0 ft                   | F<br>S<br>F<br>S | = Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing  Soil Friction = Soil height to ignore for passive pressure = | 300.0<br>130.00<br>130.00<br>0.450<br>0.00 | ) psf/ft<br>) pcf<br>) pcf<br>in |   |
| Surcharge Loads  |                              |                                     |                  | Lateral Load Applied to   | Stem                                       |                                  | Adjacent Footing Load   |
| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Over | =<br>& Overt<br>=<br>turning | 0.0 psf<br>urning<br>0.0            | ר<br>י<br>ו      | Lateral Load =<br>Height to Top =<br>Height to Bottom =<br>Load Type = Win  | 0.0 #,<br>0.00 ft<br>0.00 ft<br>d (W)      | /ft                              | Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting Type |
| Axial Load Applied<br>Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity            | =<br>=<br>=<br>=             | 0.0 lbs<br>0.0 lbs<br>0.0 in        |                  | (Ser<br>Wind on Exposed Stem <sub>=</sub><br>(Service Level)  | vice Le<br>0.0 p                           | evel)<br>sf                      | Base Above/Below Soil<br>at Back of Wall = 0.0 ft<br>Poisson's Ratio = 0.300                                  |
| Design Summary   |                              |                                     |                  | Stem Construction   |  | Bottom                           |   |
|  |                              |                                     |                  | Design Height Above Ftg   | ft =                                       | Stem Ok<br>0.00                  | ОК<br>00  |
| Wall Stability Ratios<br>Overturning<br>Sliding  | =<br>=                       | 2.81 OK<br>1.58 OK                  |                  | Wall Material Above "Ht"<br>Design Method<br>Thickness<br>Bobor Size  | =<br>=<br>=                                | Concrete<br>LRFD<br>8.00         | te<br>D<br>D0   |
| Total Bearing Loadresultant ecc.   | =<br>=                       | 1,439 lbs<br>4.26 in                |                  | Rebar Spacing<br>Rebar Placed at  | =  | # 2<br>9.00<br>Edge              | 4<br>00<br>ge   |
| Soil Pressure @ Toe<br>Soil Pressure @ Heel<br>Allowable                                       | =<br>=<br>=                  | 495 psf (<br>169 psf (<br>4.000 psf | DK<br>DK         | fb/FB + fa/Fa<br>Total Force @ Section  | =  | 0.18                             | 87  |
| Soil Pressure Less<br>ACI Factored @ Toe   | s Than A<br>=                | Allowable<br>693 psf                |                  | Service Level<br>Strength Level   | lbs =<br>lbs =                             | 800.0                            | .0  |
| ACI Factored @ Heel<br>Footing Shear @ Toe   | =                            | 236 psf<br>7.3 psi 0                | ЭK               | MomentActual<br>Service Level   | ft-# =                                     |                                  |   |
| Footing Shear @ Heel<br>Allowable  | =<br>=                       | 0.0 psi C<br>75.0 psi               | ЭK               | Strength Level<br>MomentAllowable   | ft-# =<br>=                                | 1,333.3<br>7,122.4               | .4  |
| Sliding Calcs<br>Lateral Sliding Force<br>less 100% Passive Forc<br>less 100% Friction Force   | =<br>;e = -<br>;e = -        | 720.0 lbs<br>337.5 lbs<br>802.5 lbs |                  | SnearActual<br>Service Level<br>Strength Level  | psi =<br>psi =                             | 10.7                             | .7  |
| Added Force Req'dfor 1.5 Stability   | =<br>=                       | 0.0 lbs 0<br>0.0 lbs 0              | OK<br>OK         | Anet (Masonry)<br>Rebar Depth 'd'<br>Masonry Data   | in2 =<br>in =                              | 6.25                             | 25  |
| Vertical component of activ<br>NOT considered in the calc                                      | e latera                     | soil pressure                       | IS               | f'm<br>Fs<br>Solid Grouting<br>Modular Ratio 'n'  | psi =<br>psi =<br>=<br>=                   |                                  |   |
| Load Factors<br>Building Code<br>Dead Load<br>Live Load  | IBC                          | 2018,ACI<br>1.200<br>1.600          |                  | <ul> <li> Short Term Factor</li> <li>Equiv. Solid Thick.</li> <li>Masonry Block Type</li> <li>Mosone Design Mathed</li> </ul>       | psr =<br>=<br>=<br>=                       | Medium \                         | ı Weight  |
| Earth, H<br>Wind, W<br>Seismic, E  |                              | 1.600<br>1.000<br>1.000             |                  | Masonry Design Method<br>Concrete Data<br>f'c<br>Fy   | =<br>psi =<br>psi =                        | 2,500.0<br>60,000.0              | .0<br>.0  |

| RetainPro (c) 1987-2019, Build 11.20.03.31<br>License : KW-06056595<br>License To : BYKONEN CARTER QU  | Cantilevere  | d Retaining Wall   | Code: IBC 2018,ACI 318-14,TMS 402-16   |
|--|--|--|--|
| Concrete Stem Rebar Area D   | etails   |  |  |
| Bottom Stem<br>As (based on applied moment) :  | Vertical Reinforcing<br>0.05 in2/ft  | Horizontal Reinforcing   |  |
| (4/3) * As :   | 0.0666 in2/ft  | Min Stem T&S Reinf Are   | ea 1.056 in2   |
| 200bd/fy : 200(12)(6.25)/60000 :   | 0.25 in2/ft  | Min Stem T&S Reinf Are   | ea per ft of stem Height : 0.192 in2/ft  |
| 0.0018bh : 0.0018(12)(8) :   | 0.1728 in2/ft  | Horizontal Reinforcing O   | options :  |
|  |  | One layer of : Two la  | ayers of :   |
| Required Area :  | 0.1728 in2/ft  | #4@ 12.50 in #4@   | 25.00 in   |
| Provided Area :  | 0.2667 in2/ft  | #5@ 19.38 in #5@   | 2 38.75 in   |
| Maximum Area :   | 0.8467 in2/ft  | #6@ 27.50 in #6@   | 9 55.00 in   |
| Footing Data   | Footing D  | Design Results   |  |
| Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Depth=Key Distance from Toe=f'c =2,500 psiFy =Footing Concrete Density=Min. As %=Cover @ Top2.00@ Btm.= | 3.67 ft       0.67         4.33       Mu' : Upward         2.00 in       Mu' : Downward         0.00 in       Actual 1-Way St         0.00 in       Actual 1-Way St         0.00 in       Allow 1-Way St         0.00 ft       Toe Reinforcing         0.00 psi       Heel Reinforcing         0.00 pcf       Key Reinforcing         0018       Footing Torsion         3.00 in       Footing Allow. T         If torsion examplement       Other Accepta | Toe         He           sure         =         693         2:           =         45,528         2:         2:           d         =         20,816         2:           =         2,059         3:         3:           Shear         =         7.34         0:           hear         =         75.00         75.           g         =         # 4 @ 9.00 in         9           g         =         # 4 @ 9.00 in         9           g         =         Mone Spec'd         1           n, Tu         =         0         7           Torsion, phi Tu         =         0         1           xceeds allowable, provide         tal design for footing torsio         tble Sizes & Spacings | el<br>36 psf<br>0 ft-#<br>0 ft-#<br>0 psi<br>00 psi<br>00 psi<br>0.00 ft-lbs<br>0.00 ft-lbs<br>0.00 ft-lbs |
|  | Toe: #4@ 9<br>Heel: #4@ 9<br>Key: No key   | .25 in, #5@ 14.35 in, #6@ 20<br>.25 in, #5@ 14.35 in, #6@ 20<br>/ defined  | 1.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46<br>1.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46                 |
|  | Min footing T<br>Min footing T   | &S reinf Area 1.<br>&S reinf Area per foot 0.  | 12 in2<br>26 in2 /ft   |

If one layer of horizontal bars: #4@ 9.26 in #5@ 14.35 in #6@ 20.37 in If two layers of horizontal bars: #4@ 18.52 in #5@ 28.70 in #6@ 40.74 in

| RetainPro (c) 1987-2019, Build 1<br>License : KW-06056595<br>License To : BYKONEN CAR       | 1.20.03.31<br>TER QUIN | N                           | Cantilevere            | d Retaining Wall  | Code: IBC 20                  | 18,ACI 318-1                       | 14,TMS 402-16  |  |  |  |
|---|------------------------|-----------------------------|------------------------|---|-------------------------------|------------------------------------|----------------|--|--|--|
| Summary of Overturning & Resisting Forces & Moments   |                        |                             |                        |   |                               |                                    |                |  |  |  |
| Item  | Force<br>Ibs           | /ERTURNIN<br>Distance<br>ft | G<br>Moment<br>ft-#    |   | RE<br>Force<br>Ibs            | SISTING<br>Distance<br>ft          | Moment<br>ft-# |  |  |  |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hvdrostatic Force               | 720.0                  | 2.00                        | 1,440.0                | Soil Over HL (ab. water tbl)<br>Soil Over HL (bel. water tbl)<br>Watre Table  | 0.2                           | 4.33<br>4.33                       | 0.9<br>0.9     |  |  |  |
| Buoyant Force =<br>Surcharge over Heel =<br>Surcharge Over Toe =<br>Adjacent Footing Load = |                        |                             |                        | Sloped Soil Over Heel =<br>Surcharge Over Heel =<br>Adjacent Footing Load =<br>Axial Dead Load on Stem =<br>* Axial Live Load on Stem = |                               |                                    |                |  |  |  |
| Load @ Stem Above Soil =  |                        |                             |                        | Soil Over Toe =<br>Surcharge Over Toe =   | 238.4                         | 1.83                               | 437.0          |  |  |  |
|   |                        |                             |                        | Stem Weight(s) =<br>Earth @ Stem Transitions =  | 550.0                         | 4.00                               | 2,200.2        |  |  |  |
| Total = Resisting/Overturning Ra  | 720.0<br>tio           | O.T.M. =<br>=               | 1,440.0<br><b>2.81</b> | Footing Weight =<br>Key Weight =<br>Vert. Component =   | 650.1                         | 2.17                               | 1,408.8        |  |  |  |
| Vertical Loads used for So  | oil Pressure           | = 1,438                     | .7 lbs                 | •<br><b>Total =</b><br>* Axial live load NOT included   | 1,438.7 I<br>in total display | bs <b>R.M.=</b><br>ed, or used for | 4,046.9        |  |  |  |

\* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Overturning Resistance.

# Tilt

# Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus                                | 250.0               | pci                      |
|---|---------------------|--------------------------|
| Horizontal Defl @ Top of Wall (approximate only)            | 0.017               | in                       |
| The above calculation is not valid if the heel soil bearing | <u>g pressure e</u> | exceeds that of the toe, |
| · · · · · · · · · · · · · · · · · · ·                       |                     |                          |

because the wall would then tend to rotate into the retained soil.

This Wall in File and a finally and the second state by the regidence acturges aclaulations rates achadula 0.140

| RetainPro (c) 1987-2019, Build<br>License : KW-06056595<br>License To : BYKONEN CA  | 11.20.03.31<br>RTER QUINN                                 | Cantilevered Retai  | ning Wall  | Code: IBC 2018,ACI 318-14,TMS 402-16   |
|---|---|---|--|--|
| Criteria  |   | Soil Data   |  |  |
| Retained Height =<br>Wall height above soil =<br>Slope Behind Wall =<br>Height of Soil over Toe =<br>Water height over heel = | = 5.00 ft<br>= 0.50 ft<br>= 0.00<br>= 6.00 in<br>= 0.0 ft | Allow Soil Bearing =<br>Equivalent Fluid Pressure Met<br>Active Heel Pressure =<br>Passive Pressure =<br>Soil Density, Heel =<br>Soil Density, Toe =<br>Footing  Soil Friction =<br>Soil height to ignore   | 5,332.0 psf<br>hod<br>40.0 psf/ft<br>300.0 psf/ft<br>130.00 pcf<br>130.00 pcf<br>0.450 |  |
| Surcharge Loads   |   | Lateral Load Applied t  | o Stem   | Adiacent Footing Load  |
| Surcharge Over Heel =<br>Used To Resist Sliding &<br>Surcharge Over Toe =<br>Used for Sliding & Overtu<br>Axial Load Applied  | = 0.0 psf<br>& Overturning<br>= 0.0<br>urning<br>to Stem  | Lateral Load =<br>Height to Top =<br>Height to Bottom =<br>Load Type = W<br>(\$   | 0.0 #/ft<br>0.00 ft<br>0.00 ft<br>/ind (W)<br>Service Level)<br>0.0 psf                | Adjacent Footing Load=0.0 lbsFooting Width=0.00 ftEccentricity=0.00 inWall to Ftg CL Dist=0.00 ftFooting TypeLine LoadBase Above/Below Soil=other Brack of Woll=0.0 ft |
| Axial Live Load =<br>Axial Load Eccentricity =  | = 0.0 lbs<br>= 0.0 in                                     | (Service Level)   | 0.0 par  | Poisson's Ratio = 0.300  |
| Earth Pressure Sei  | smic Load   |   |  |  |
| Method:Uniform<br>Multiplier Used =<br>(Multiplier used on soil de  | = 9.000<br>ensity)  | Uniform Seismic Force =<br>Total Seismic Force = 3  | 54.000<br>24.000   |  |
| Design Summary  |   | Stem Construction   | Botto  | m  |
| Wall Stability Ratios<br>Overturning<br>Sliding   | = 2.61 OK<br>= 1.20 Ratio                                 | Control Con | <b>Ftg</b> ft =<br>-tt" = Conc<br>= Ll<br>=<br>= #                                     | 0.00<br>rete<br>RFD<br>3.00<br>4   |
| Total Bearing Loadresultant ecc.  | = 1,439 lbs<br>= 9.93 in                                  | Rebar Spacing<br>Rebar Placed at  | =<br>= E   | 9.00<br>dge  |
| Soil Pressure @ Toe<br>Soil Pressure @ Heel<br>Allowable<br>Soil Pressure Less  | = 716 psf (<br>= 0 psf (<br>= 5,332 psf<br>Than Allowable | OK fb/FB + fa/Fa<br>OK Total Force @ Section<br>Service Level   | = 0<br>n<br>lbs =  | .281   |
| ACI Factored @ Toe<br>ACI Factored @ Heel   | = 1,003 psf<br>= 0 psf                                    | Strength Level<br>MomentActual  | IDS = 1,0  | /0.0   |
| Footing Shear @ Toe   | = 10.1 psi 0  | Strength Level  | ft-# = 2,0   | 08.3   |
| Allowable   | = 4.8 psi 0<br>= 75.0 psi                                 | MomentAllowable   | = 7,1  | 22.4   |
| Lateral Sliding Force<br>less 100% Passive Force<br>less 100% Friction Force  | = 946.8 lbs<br>e = - 337.5 lbs<br>= - 802.5 lbs           | Service Level<br>Strength Level<br>ShearAllowable   | psi =<br>psi =<br>psi =  | 14.3<br>75.0   |
| Added Force Req'd<br>for 1.5 Stability  | = 0.0 lbs 0<br>= 280.2 lbs 1                              | OK Anet (Masonry)<br>IG Rebar Depth 'd'<br>Masonry Data   | in2 =<br>in =  | 5.25   |
| Vertical component of active  | e lateral soil pressure                                   | f'm<br>Fs<br>IS Solid Grouting  | psi =<br>psi =<br>=  |  |

Modular Ratio 'n'

Short Term Factor

Equiv. Solid Thick.

Masonry Block Type

Masonry Design Method

Wall Weight

Concrete Data

f'c

Fy

=

=

=

= ASD

psi = 60,000.0

psf =

psi =

100.0

= Medium Weight

2,500.0

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

| Lood Ecotoro  |              |
|---------------|--------------|
| Load Factors  |              |
| Building Code | IBC 2018,ACI |
| Dead Load     | 1.200        |
| Live Load     | 1.600        |
| Earth, H      | 1.600        |
| Wind, W       | 1.000        |
| Seismic, E    | 1.000        |
|               |              |

#4@ 18.52 in

#5@ 28.70 in

#6@ 40.74 in

This Wall in File: p:\studio ectypos\steinborn residence ectypos\calculations\retain schedule - site

| RetainPro (c) 1987-2019, Build 11<br>License : KW-06056595<br>License To : BYKONEN CART  | .20.03.31<br>FER QUINN   | Cantilevered R  | etaining Wall   | Code: IBC 2018,ACI 318-14,TMS 402-16   |
|--|--|---|---|--|
| Concrete Stem Rebar  | Area Details   |   |   |  |
| Bottom Stem<br>As (based on applied moment   | ) : 0.0752   | I Reinforcing<br>in2/ft   | Horizontal Reinforci  | ing  |
| (4/3) * As :   | 0.1003   | in2/ft  | Min Stem T&S Reir   | of Area 1.056 in2  |
| 200bd/fy:200(12)(6.25)/6000  | 0 : 0.25 in  | 2/ft  | Min Stem T&S Reir   | of Area per ft of stem Height : 0.192 in2/ft   |
| 0.0018bh : 0.0018(12)(8) :   | 0.1728   | in2/ft  | Horizontal Reinforci  | ing Options :  |
|  | =====  | ======  | One layer of : 1  | Two layers of :  |
| Required Area :  | 0.1728   | in2/ft  | #4@ 12.50 in  | #4@ 25.00 in   |
| Provided Area :  | 0.2667   | in2/ft  | #5@ 19.38 in  | #5@ 38.75 in   |
| Maximum Area :   | 0.8467   | in2/ft  | #6@ 27.50 in  | #6@ 55.00 in   |
| Footing Data   |  | Footing Desi  | gn Results  |  |
| Toe Width=Heel Width=Total Footing Width=Footing Thickness=Key Width=Key Depth=Key Distance from Toe=f'c=2,500 psiFyFooting Concrete Density=Min. As %=Cover @ Top2.00 | 3.67 ft<br>0.67<br>4.33<br>12.00 in<br>0.00 in<br>0.00 in<br>0.00 ft<br>= 60,000 psi<br>150.00 pcf<br>0.0018<br>2 Btm= 3.00 in | Factored Pressure<br>Mu': Upward<br>Mu': Downward<br>Mu: Design<br>Actual 1-Way Shear<br>Allow 1-Way Shear<br>Toe Reinforcing<br>Heel Reinforcing<br>Key Reinforcing<br>Footing Torsion, Tu<br>Footing Allow. Torsi | Toe<br>= 1,003<br>= 56,286<br>= 20,816<br>= 2,956<br>r = 10.14<br>= 75.00<br>= # 4 @ 9.00 in<br>= # 4 @ 9.00 in<br>= None Spec'd<br>=<br>on, phi Tu = | Heel<br>0 psf<br>0 ft-#<br>0 ft-#<br>4.84 psi<br>75.00 psi<br>0.00 ft-lbs<br>0.00 ft-lbs |
|  |  | If torsion excee<br>supplemental d  | ds allowable, prov  | ide<br>orsion.   |
|  |  | Other Acceptable<br>Toe: #4@ 9.25 in  | Sizes & Spacings<br>n, #5@ 14.35 in, #6   | @ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46   |
|  |  | Heel: #4@ 9.25 in<br>Key: No key def  | n, #5@ 14.35 in, #6<br>ined   | @ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46   |
|  |  | Min footing T&S r<br>Min footing T&S r<br>If one layer of hor   | einf Area<br>einf Area per foot<br>izontal bars:  | 1.12 in2<br>0.26 in2 /ft<br>If two layers of horizontal bars:                            |

#4@ 9.26 in

#5@ 14.35 in

#6@ 20.37 in

| RetainPro (c) 1987-2019, Bu<br>License : KW-06056595<br>License To : BYKONEN   | uild 11.:<br>CART          | 20.03.31<br>ER QUINN | l                           | Cantilevere          | d Retaining Wall  | Code: IBC 20   | 18,ACI 318-   | 14,TMS 402-16                       |
|--|----------------------------|----------------------|-----------------------------|----------------------|---|--|---|-------------------------------------|
| Summary of Overturning & Resisting Forces & Moments  |                            |                      |                             |                      |   |  |   |                                     |
| Item   |                            | <b>Force</b><br>Ibs  | ERTURNING<br>Distance<br>ft | S<br>Moment<br>ft-#  |   | RE<br>Force<br>Ibs   | SISTING<br>Distance<br>ft                                 | Moment<br>ft-#                      |
| HL Act Pres (ab water tbl<br>HL Act Pres (be water tbl<br>Hydrostatic Force<br>Buoyant Force<br>Surcharge over Heel<br>Surcharge Over Toe<br>Adjacent Footing Load | )<br>)<br>=<br>=<br>=<br>= | 720.0                | 2.00                        | 1,440.0              | Soil Over HL (ab. water tbl<br>Soil Over HL (bel. water tb<br>Watre Table<br>Sloped Soil Over Heel =<br>Surcharge Over Heel =<br>Adjacent Footing Load =<br>Axial Dead Load on Stem = | ) 0.2<br> )<br>:<br>:  | 4.33<br>4.33  | 0.9<br>0.9                          |
| Load @ Stem Above Soil<br>Seismic Earth Load   | =<br>=<br>=<br>=           | 226.8                | 3.00                        | 680.4                | Soil Over Toe =<br>Surcharge Over Toe =<br>Stem Weight(s) =   | 238.4<br>550.0   | 1.83<br>4.00  | 437.0<br>2,200.2                    |
| Total  | =                          | 946.8                | O.T.M. =                    | 2,120.4              | Earth @ Stem Transitions=<br>Footing Weight =<br>Key Weight =   | : 650.1<br>:   | 2.17  | 1,408.8                             |
| Resisting/Overturning<br>Vertical Loads used for   | g Ratio                    | D<br>Pressure :      | =<br>= 1,438.               | <b>2.61</b><br>7 lbs | Vert. Component =<br>Total :<br>* Axial live load NOT included<br>resistance, but is included 1   | = 344.7<br>= 1,783.4 I<br>d in total display<br>or soil pressure | 4.33<br>bs <b>R.M.=</b><br>ed, or used fo<br>calculation. | 1,494.1<br>5,541.0<br>r overturning |

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

# Tilt

# Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus | 250.0 pci |
|------------------------------|-----------|
|------------------------------|-----------|

Horizontal Defl @ Top of Wall (approximate only) 0.025 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Seismic, E

1.000

Fy

psi = 60,000.0

| This Wall in File: p:\studio e  | ectypos\steinborn resider   | nce ectypos\calculations\retain sc  | hedule   | e - site   |  |  |
|---|---|---|--|--|--|--|
| RetainPro (c) 1987-2019, Built<br>License : KW-06056595<br>License To : BYKONEN C   | d 11.20.03.31<br>ARTER QUINN  | Cantilevered Retaini  | ing V  | Vall   | Code: IBC 2018,A   | CI 318-14,TMS 402-16   |
| Criteria  |   | Soil Data   |  |  |  |  |
| Retained Height<br>Wall height above soil<br>Slope Behind Wall<br>Height of Soil over Toe<br>Water height over heel   | = 4.00 ft<br>= 0.50 ft<br>= 0.00<br>= 6.00 in<br>= 0.0 ft   | Allow Soil Bearing       =       4         Equivalent Fluid Pressure Metho         Active Heel Pressure       =         Passive Pressure       =         Soil Density, Heel       =         Soil Density, Toe       =         Footing  Soil Friction       =         Soil height to ignore       for passive pressure       = | 4,000.0<br>d<br>300.0<br>130.00<br>130.00<br>0.450<br>0.00 | psf<br>psf/ft<br>psf/ft<br>pcf<br>pcf  |  |  |
| Surcharge Loads   |   | Lateral Load Applied to   | Stem   |  | Adjacent Footing   | Load   |
| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Over<br>Axial Load Applied<br>Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity | = 0.0 psf<br>& Overturning<br>= 0.0<br>rturning<br>d to Stem<br>= 0.0 lbs<br>= 0.0 lbs<br>= 0.0 in      | Lateral Load =<br>Height to Top =<br>Height to Bottom =<br>Load Type = Win<br>(Ser<br>Wind on Exposed Stem =<br>(Service Level)   | 0.0 #,<br>0.00 ft<br>0.00 ft<br>d (W)<br>vice Le<br>0.0 ps | /ft<br>evel)<br>sf   | Adjacent Footing Load<br>Footing Width<br>Eccentricity<br>Wall to Ftg CL Dist<br>Footing Type<br>Base Above/Below Soil<br>at Back of Wall<br>Poisson's Ratio | = 0.0 lbs<br>= 0.00 ft<br>= 0.00 in<br>= 0.00 ft<br>Line Load<br>= 0.0 ft<br>= 0.300 |
| Design Summary  |   | Stem Construction   |  | Bottom   |  |  |
| Wall Stability Ratios<br>Overturning<br>Sliding<br>Total Bearing Load<br>resultant ecc.<br>Soil Pressure @ Toe<br>Soil Pressure @ Heel  | = 2.58 OK<br>= 1.62 OK<br>= 866 lbs<br>= 5.50 in<br>= 769 psf OK<br>= 0 psf OK                          | Design Height Above Ftg<br>Wall Material Above "Ht"<br>Design Method<br>Thickness<br>Rebar Size<br>Rebar Spacing<br>Rebar Placed at<br>Design Data<br>fb/FB + fa/Fa<br>Total Force @ Section  | ft =<br>=<br>=<br>=<br>=<br>=                              | Stem Ok<br>0.00<br>Concrete<br>LRFD<br>8.00<br># 4<br>10.00<br>Edge<br>0.105 | ;  |  |
| Allowable<br>Soil Pressure Less<br>ACI Factored @ Toe<br>ACI Factored @ Heel<br>Footing Shear @ Heel<br>Allowable   | = 4,000 psi<br>s Than Allowable<br>= 1,077 psf<br>= 0 psf<br>= 8.3 psi OK<br>= 4.0 psi OK<br>= 75.0 psi | Service Level<br>Strength Level<br><b>MomentActual</b><br>Service Level<br>Strength Level<br>MomentAllowable<br><b>ShearActual</b>  | lbs =<br>lbs =<br>ft-# =<br>ft-# =<br>=                    | 512.0<br>682.7<br>6,444.1  |  |  |
| Lateral Silding Force<br>less 100% Passive Force<br>less 100% Friction Force<br>Added Force Req'd<br>for 1.5 Stability  | = 467.2 lbs<br>ce = - 266.7 lbs<br>e = - 490.4 lbs<br>= 0.0 lbs OK<br>= 0.0 lbs OK                      | Service Level<br>Strength Level<br>ShearAllowable<br>Anet (Masonry)<br>Rebar Depth 'd'<br>Masonry Data  | psi =<br>psi =<br>psi =<br>in2 =<br>in =                   | 6.8<br>75.0<br>6.25  |  |  |
| Vertical component of activ<br>NOT considered in the calc<br>Load Factors<br>Building Code<br>Dead Load<br>Live Load<br>Earth, H  | ve lateral soil pressure IS<br>culation of soil bearing<br>IBC 2018,ACI<br>1.200<br>1.600<br>1.600      | f'm<br>Fs<br>Solid Grouting<br>Modular Ratio 'n'<br>Wall Weight<br>Short Term Factor<br>Equiv. Solid Thick.<br>Masonry Block Type<br>Masonry Design Method  | psi =<br>psi =<br>=<br>psf =<br>=<br>=<br>=                | 100.0<br>Medium V<br>ASD   | Veight   |  |
| Wind, W   | 1.000   | f'c   | psi =  | 2,500.0  |  |  |

| RetainPro (c) 1987-2019, Build 11.20.03.31<br>License : KW-06056595<br>License To : BYKONEN CARTER QUINN   | Cantilevered F   | Retaining Wall  | Code: IBC 2018,ACI 318-14,TMS 402-16   |
|--|--|---|--|
| Concrete Stem Rebar Area Details   |  |   |  |
| Bottom Stem Vertical<br>As (based on applied moment) : 0.0256  | Reinforcing<br>in2/ft  | Horizontal Reinforcing  |  |
| (4/3) * As : 0.0341  | in2/ft   | Min Stem T&S Reinf Ar   | ea 0.864 in2   |
| 200bd/fy : 200(12)(6.25)/60000 : 0.25 in2  | 2/ft   | Min Stem T&S Reinf Ar   | ea per ft of stem Height : 0.192 in2/ft  |
| 0.0018bh : 0.0018(12)(8) : 0.1728  | in2/ft   | Horizontal Reinforcing (  | Options :  |
| =====  |  | One layer of : Two  | layers of :  |
| Required Area : 0.1728   | in2/ft   | #4@ 12.50 in #4@  | 25.00 in   |
| Provided Area : 0.24 in2   | 2/ft   | #5@ 19.38 in #5@  | 2 38.75 in   |
| Maximum Area : 0.8467  | in2/ft   | #6@ 27.50 in #6@  | ⊉ 55.00 in   |
| Footing Data   | Footing Des  | ign Results   |  |
| Toe Width= $1.75 \text{ ft}$ Heel Width= $0.67$ Total Footing Width= $2.42$ Footing Thickness= $10.00 \text{ in}$ Key Width= $0.00 \text{ in}$ Key Depth= $0.00 \text{ in}$ Key Distance from Toe= $0.00 \text{ ft}$ f'c = $2,500 \text{ psi}$ Fy = $60,000 \text{ psi}$ Footing Concrete Density= $150.00 \text{ pcf}$ Min. As %= $0.0018$ Cover @ Top $2.00$ @ Btm.= $3.00 \text{ in}$ | Factored Pressure<br>Mu': Upward<br>Mu': Downward<br>Mu: Design<br>Actual 1-Way Shear<br>Allow 1-Way Shear<br>Toe Reinforcing<br>Heel Reinforcing<br>Key Reinforcing<br>Footing Torsion, Tu<br>Footing Allow. Tors | Toe         H           =         1,077           =         14,665           =         4,190           =         873           r         =         827         3           =         75.00         75           =         # 4 @ 11.11 in           =         # 4 @ 11.11 in           =         None Spec'd           =         =           ion, phi Tu         = | eel<br>0 psf<br>0 ft-#<br>0 ft-#<br>3.98 psi<br>5.00 psi<br>0.00 ft-lbs<br>0.00 ft-lbs                                 |
|  | If torsion excee<br>supplemental o   | eds allowable, provide<br>lesign for footing torsi  | on.  |
|  | Other Acceptable<br>Toe: #4@ 11.11<br>Heel: #4@ 11.11<br>Key: No key def<br>Min footing T&S<br>If one layer of bot   | Sizes & Spacings           in, #5@ 17.22 in, #6@ 2           in, #5@ 17.22 in, #6@ 2           ined           reinf Area         0           reinf Area         0           rizzotal bars:         16 th  | 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5<br>24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5<br>0.52 in2<br>0.22 in2 /ft |

- #4@ 11.11 in #5@ 17.22 in #6@ 24.44 in
- 0.22 in 2 /it If two layers of horizontal bars: #4@ 22.22 in #5@ 34.44 in #6@ 48.89 in

| License : KW-06056595<br>License To : BYKONEN CAI   | RTER QUIN            | N                            |                       |   | Dode: IBC 20        | 18,AUI 318-1              | 14,1105 402-     |
|---|----------------------|------------------------------|-----------------------|---|---------------------|---------------------------|------------------|
| Summary of Overtu   | rning & R            | esisting F                   | orces & Mon           | nents   |                     |                           |                  |
| ltem  | Force<br>Ibs         | /ERTURNING<br>Distance<br>ft | G<br>Moment<br>ft-#   |   | RE<br>Force<br>Ibs  | SISTING<br>Distance<br>ft | Moment<br>ft-#   |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hydrostatic Force               | 467.2                | 1.61                         | 752.7                 | Soil Over HL (ab. water tbl)<br>Soil Over HL (bel. water tbl)<br>Watre Table  | 0.2                 | 2.42<br>2.42              | 0.4<br>0.4       |
| Buoyant Force =<br>Surcharge over Heel =<br>Surcharge Over Toe =<br>Adjacent Footing Load = |                      |                              |                       | Sloped Soil Over Heel =<br>Surcharge Over Heel =<br>Adjacent Footing Load =<br>Axial Dead Load on Stem =<br>* Axial Live Load on Stem = |                     |                           |                  |
| Load @ Stem Above Soil =  |                      |                              |                       | Soil Over Toe =<br>Surcharge Over Toe =   | 113.8               | 0.88                      | 99.5             |
| _   |                      |                              |                       | Stem Weight(s) =<br>Earth @ Stem Transitions=   | 450.0               | 2.08                      | 937.5            |
| Total =   | 467.2                | O.T.M. =                     | 752.7                 | Footing Weight =<br>Key Weight =  | 302.1               | 1.21                      | 365.1            |
| Resisting/Overturning Ra<br>Vertical Loads used for S                                       | atio<br>oil Pressure | = 866.                       | <b>2.58</b><br>.0 lbs | Vert. Component =<br>Total =  | 223.7<br>1,089.8 II | 2.42<br>os <b>R.M.=</b>   | 540.7<br>1,943.3 |

<sup>t</sup> Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

# Tilt

# Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus                                    | 250.0    | pci                      |
|---|----------|--------------------------|
| Horizontal Defl @ Top of Wall (approximate only)                | 0.040    | in                       |
| The above calculation is not valid if the heel soil bearing pre | essure e | exceeds that of the toe, |

because the wall would then tend to rotate into the retained soil.

| License : KW-06056595<br>License To : BYKONEN CA  |                            |  |                      | Cantilevered Retaining Wall  |  |                            | Code: IBC 2018,A0   | CI 318-14,TMS 402-16  |
|---|----------------------------|--|----------------------|--|--|----------------------------|---|---|
| Criteria  |                            |  | S                    | oil Data   |  |                            |   |   |
| Retained Height<br>Wall height above soil<br>Slope Behind Wall  | =<br>=<br>=                | 4.00 ft<br>0.50 ft<br>0.00                     | All<br>Eq<br>Ac      | ow Soil Bearing =<br>uivalent Fluid Pressure Meth<br>tive Heel Pressure =  | 5,332.0<br>iod<br>40.0                               | psf<br>psf/ft              |   |   |
| Height of Soil over Toe   | =                          | 6.00 in<br>0.0 ft                              | Pa<br>So<br>So<br>Fo | ssive Pressure =<br>il Density, Heel =<br>il Density, Toe =<br>oting  Soil Friction =<br>il height to ignore<br>for passive pressure = | 300.0<br>130.00<br>130.00<br>0.450<br>0.00           | psf/ft<br>pcf<br>pcf<br>in |   |   |
| Surcharge Loads   |                            |  |                      | ateral Load Applied to   | Stem   |                            | Adjacent Footing I  | oad   |
| Surcharge Over Heel<br>Used To Resist Sliding<br>Surcharge Over Toe<br>Used for Sliding & Overt<br>Axial Load Applied | =<br>& Ove<br>=<br>turning | 10.0 psf<br>rturning<br>0.0<br>g<br><b>tem</b> | La<br><br>Lo         | teral Load =<br>Height to Top =<br>Height to Bottom =<br>wad Type = Wi<br>(S   | 0.0 #/<br>0.00 ft<br>0.00 ft<br>ind (W)<br>ervice Le | ft<br>evel)                | Adjacent Footing Load<br>Footing Width<br>Eccentricity<br>Wall to Ftg CL Dist<br>Footing Type | = 0.0 lbs<br>= 0.00 ft<br>= 0.00 in<br>= 0.00 ft<br>Line Load |
| Axial Dead Load<br>Axial Live Load<br>Axial Load Eccentricity   | =<br>=<br>=                | 0.0 lbs<br>0.0 lbs<br>0.0 in                   | W<br>(               | /ind on Exposed Stem _<br>Service Level)   | 0.0 ps   | sf                         | at Back of Wall<br>Poisson's Ratio  | = 0.0 ft<br>= 0.300   |
| Earth Pressure Se   | ismio                      | : Load   |                      |  |  |                            |   |   |
| Method:Uniform<br>Multiplier Used<br>(Multiplier used on soil de  | = s<br>ensity)             | 9.000  | Uı<br>To             | niform Seismic Force = 2<br>otal Seismic Force = 2   | 43.500<br>10.250                                     |                            |   |   |
| Design Summary  |                            |  |                      | Stem Construction  |  | Bottom                     |   |   |
| Wall Stability Ratios<br>Overturning<br>Sliding   | =                          | 1.70 OK<br>1.20 Rat                            | 0 < 1.               | Design Height Above F<br>Wall Material Above "H<br>Design Method<br>5! Thickness<br>Rebar Size   | <b>tg</b> ft =<br>t" =<br>=<br>=                     | Concrete<br>LRFD<br>8.00   |   |   |
| Total Bearing Loadresultant ecc.  | =<br>=                     | 866 lbs<br>10.92 in                            |                      | Rebar Spacing<br>Rebar Placed at   | =  | 10.00<br>Edge              |   |   |
| Soil Pressure @ Toe<br>Soil Pressure @ Heel<br>Allowable  | =<br>=<br>=                | 1,936 psf<br>0 psf<br>5,332 psf                | OK<br>OK             | fb/FB + fa/Fa<br>Total Force @ Section   | =<br>1<br>lbs –                                      | 0.166                      | ;   |   |
| Soil Pressure Less<br>ACI Factored @ Toe<br>ACI Factored @ Heel   | Than<br>=<br>=             | Allowable<br>2,711 psf<br>0 psf                |                      | Strength Level<br>MomentActual   | lbs =<br>ft-# =                                      | 705.7                      |   |   |
| Footing Shear @ Toe<br>Footing Shear @ Heel<br>Allowable  | =<br>=<br>=                | 11.6 psi<br>4.0 psi<br>75.0 psi                | OK<br>OK             | Strength Level<br>MomentAllowable<br>ShearActual   | ft-# =<br>=  | 1,070.1<br>6,444.1         |   |   |
| Lateral Sliding Force<br>less 100% Passive Force<br>less 100% Friction Force  | =<br>e = -<br>e = -        | 629.3 lbs<br>266.7 lbs<br>490.4 lbs            |                      | Service Level<br>Strength Level<br>ShearAllowable  | psi =<br>psi =<br>psi =                              | 9.4<br>75.0                |   |   |
| Added Force Req'd<br>for 1.5 Stability  | =<br>=                     | 0.0 lbs<br>186.8 lbs                           | OK<br>NG             | Anet (Masonry)<br>Rebar Depth 'd'<br>Masonry Data  | in2 =<br>in =  | 6.25                       |   |   |
| Vertical component of active  | e later                    | al soil pressur                                | e IS                 | f'm<br>Fs<br>Solid Grouting  | psi =<br>psi =<br>=                                  |                            |   |   |

Wall Weight

Concrete Data

f'c

Fy

Short Term Factor

Equiv. Solid Thick.

Masonry Block Type

Masonry Design Method

psf =

psi =

=

=

= ASD

psi = 60,000.0

100.0

= Medium Weight

2,500.0

Load FactorsBuilding CodeIBC 2018,ACIDead Load1.200Live Load1.600Earth, H1.600Wind, W1.000Seismic, E1.000

| RetainPro (c) 1987-2019, Build 11.20.03.31<br>License : KW-06056595<br>License To : BYKONEN CARTER QUINN  | Cantilevered  | d Retaining Wall   | Code: IBC 2018,ACI 318-14,TMS 402-16   |
|---|---|--|--|
| Concrete Stem Rebar Area Detai  | ls  |  |  |
| Bottom Stem<br>As (based on applied moment) :   | Vertical Reinforcing<br>0.0401 in2/ft   | Horizontal Reinforcing   |  |
| (4/3) * As :<br>200bd/fu : 200(12)/6 25)/60000 :  | 0.0535 in2/ft   | Min Stem T&S Reinf A   | rea 0.864 in2  |
| 0.0018bh : 0.0018(12)(8) :  | 0.1728 in2/ft   | Horizontal Reinforcing   | Options :  |
| Required Area :<br>Provided Area :<br>Maximum Area :  | ======================================  | One layer of : Two<br>#4@ 12.50 in #4<br>#5@ 19.38 in #5<br>#6@ 27.50 in #6  | 0 layers of :<br>@ 25.00 in<br>@ 38.75 in<br>@ 55.00 in  |
| Footing Data  | Footing D   | esign Results  |  |
| Toe Width= $1.75 \text{ f}$ Heel Width= $0.67$ Total Footing Width= $2.42$ Footing Thickness= $10.00 \text{ in}$ Key Width= $0.00 \text{ in}$ Key Depth= $0.00 \text{ in}$ Key Distance from Toe= $0.00 \text{ fr}$ f'c = $2,500 \text{ psi}$ Fy = $60,000 \text{ p}$ Footing Concrete Density= $150.00 \text{ p}$ Min. As %= $0.0018$ Cover @ Top $2.00$ @ Btm= $3.00$ | t<br>Factored Pressu<br>Mu': Upward<br>Mu': Downward<br>Mu: Design<br>Actual 1-Way Sh<br>Allow 1-Way Sh<br>t Toe Reinforcing<br>Footing Torsion,<br>0 in Footing Allow. To<br>If torsion ex<br>supplement<br>Other Acceptat<br>Toe: #4@ 11<br>Heel: #4@ 11<br>Key: No key | Toe         L           ure $2,711$ $= 21,124$ $= 4,190$ $= 1,411$ $= 1,411$ hear $= 1,411$ hear $= 1,61$ $= # 4 @ 11.11 in$ $= 14.02 m c^{-1}$ $= # 4 @ 11.11 in$ $= 1000000000000000000000000000000000000$ | leel       0 psf         0 ft-#       0 ft-#         0 ft-#       0 ft-#         3.98 psi       5.00 psi         0.00 ft-lbs       0.00 ft-lbs         0.00 ft-lbs       0.00 ft-lbs         24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5         24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 |

If one layer of horizontal bars: #4@ 11.11 in #5@ 17.22 in #6@ 24.44 in 0.22 in2 /tt
 If two layers of horizontal bars:
 #4@ 22.22 in
 #5@ 34.44 in
 #6@ 48.89 in

Moment

ft-#

#### This Wall in File: p:\studio ectypos\steinborn residence ectypos\calculations\retain schedule - site

| RetainPro (c) 1987-2019, Build 11.20.03.31<br>License : KW-06056595<br>License To : BYKONEN CARTER QUINN | Cantilevered Retaining Wall | Code: IBC 2018,ACI 318-14,TMS 402-16 |
|--|-----------------------------|--------------------------------------|
| Summary of Overturning & Resist  | ing Forces & Moments        |                                      |

|   |   |              |                             | ń              |  |
|---|---|--------------|-----------------------------|----------------|--|
| Item  |   | Force<br>Ibs | ERTURNING<br>Distance<br>ft | Moment<br>ft-# |  |
| HL Act Pres (ab water tbl)<br>HL Act Pres (be water tbl)<br>Hydrostatic Force           | ) | 467.2        | 1.61                        | 752.7          |  |
| Buoyant Force   | = |              |                             |                |  |
| Surcharge over Heel   | = | 14.9         | 2.42                        | 35.9           |  |
| Surcharge Over Toe  | = |              |                             |                |  |
| Adjacent Footing Load   | = |              |                             |                |  |
| Added Lateral Load  | = |              |                             |                |  |
| Load @ Stem Above Soil  | = |              |                             |                |  |
| Seismic Earth Load  | = | 147.2        | 2.42                        | 355.7          |  |
|   | = |              |                             |                |  |
| Total   | = | 629.3        | O.T.M. =                    | 1,144.4        |  |
| Resisting/Overturning Ratio = 1.70<br>Vertical Loads used for Soil Pressure = 866.1 lbs |   |              |                             |                |  |

|           | Tota              | al = | 1,089.8 | lbs R | .M.= | 1.943. | 3 |
|-----------|-------------------|------|---------|-------|------|--------|---|
| Vert. C   | omponent          | =    | 223.7   | _     | 2.42 | 540.   | 7 |
| Key W     | eight             | =    |         |       |      |        |   |
| Footing   | g Weight          | =    | 302.1   |       | 1.21 | 365.   | 1 |
| Earth @   | Stem Transition   | S =  |         |       |      |        |   |
| Stem V    | Veight(s)         | =    | 450.0   |       | 2.08 | 937.   | 5 |
| Surcha    | rge Over Toe      | =    |         |       |      |        |   |
| Soil Ov   | er Toe            | =    | 113.8   |       | 0.88 | 99.    | 5 |
| * Axial L | ive Load on Stem  | =    |         |       |      |        |   |
| Axial D   | ead Load on Sten  | n =  |         |       |      |        |   |
| Adjace    | nt Footing Load   | =    |         |       |      |        |   |
| Surcha    | rge Over Heel     | =    | 0.0     |       | 2.42 | 0.     | 0 |
| Sloped    | Soil Over Heel    | =    |         |       |      |        |   |
| Watre     | Table             |      |         |       |      |        |   |
| Soil Ov   | er HL (bel. water | tbl) |         |       | 2.42 | 0.     | 4 |
| Soil Ov   | er HL (ab. water  | tbl) | 0.2     |       | 2.42 | 0.     | 4 |
|           |                   |      |         |       |      |        |   |

\* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Force

lbs

.....RESISTING .....

Distance

ft

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

### Tilt

# Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

| Soil Spring Reaction Modulus 2 | 50.0 | pci |  |
|--------------------------------|------|-----|--|
|--------------------------------|------|-----|--|

Horizontal Defl @ Top of Wall (approximate only) 0.100 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.





# Roof, 5/ Drop Beam 1 piece(s) 5 1/4" x 20" 2.2E Parallam® PSL



24' 1"

All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results        | Actual @ Location | Allowed       | Result         | LDF  | Load: Combination (Pattern) |
|-----------------------|-------------------|---------------|----------------|------|-----------------------------|
| Member Reaction (lbs) | 12504 @ 4"        | 18047 (5.50") | Passed (69%)   |      | 1.0 D + 1.0 S (All Spans)   |
| Shear (lbs)           | 10378 @ 2' 1 1/2" | 23345         | Passed (44%)   | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Moment (Ft-Ibs)       | 74037 @ 12' 6"    | 80713         | Passed (92%)   | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Live Load Defl. (in)  | 0.708 @ 12' 6"    | 1.217         | Passed (L/412) |      | 1.0 D + 1.0 S (All Spans)   |
| Total Load Defl. (in) | 1.099 @ 12' 6"    | 1.622         | Passed (L/266) |      | 1.0 D + 1.0 S (All Spans)   |

System : Roof Member Type : Drop Beam Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD Member Pitch : 0/12

0

2

• Deflection criteria: LL (L/240) and TL (L/180).

• A 17% decrease in the moment capacity has been added to account for lateral stability.

1

0

|   | Bearing Length |                |               | Loads          | to Supports  |              |             |
|---|----------------|----------------|---------------|----------------|--------------|--------------|-------------|
| Supports                                      | Total          | Available      | Required      | Dead           | Snow         | Factored     | Accessories |
| 1 - Column - DF                               | 5.50"          | 5.50"          | 3.81"         | 4441           | 8063         | 12504        | Blocking    |
| 2 - Column - DF                               | 5.50"          | 5.50"          | 3.81"         | 4441           | 8063         | 12504        | Blocking    |
| - Blocking Danola are accumed to commune load | a applied dire | ath a have the | m and the ful | Llood is appli | d to the mer | mhar haing d | anianad     |

Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing  | Bracing Intervals  | Comments |
|------------------|--------------------|----------|
| Top Edge (Lu)    | End Bearing Points |          |
| Bottom Edge (Lu) | End Bearing Points |          |

|                       |                  |                 | Dead   | Snow   |              |
|-----------------------|------------------|-----------------|--------|--------|--------------|
| Vertical Loads        | Location (Side)  | Tributary Width | (0.90) | (1.15) | Comments     |
| 0 - Self Weight (PLF) | 0 to 25'         | N/A             | 32.8   |        |              |
| 1 - Uniform (PSF)     | 0 to 25' (Front) | 21' 6"          | 15.0   | 30.0   | Default Load |

#### Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

| ForteWEB Software Operator   | Job Notes |
|--|-----------|
| Jane Johnson<br>Bykonen Carter Quinn<br>(206) 264-7784<br>jaj@bcq-se.com |           |





# Roof, 10/ Header 1 piece(s) 5 1/4" x 14" 2.0E Parallam® PSL





All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results        | Actual @ Location | Allowed      | Result         | LDF  | Load: Combination (Pattern) |
|-----------------------|-------------------|--------------|----------------|------|-----------------------------|
| Member Reaction (lbs) | 6977 @ 1 1/2"     | 9844 (3.00") | Passed (71%)   |      | 1.0 D + 1.0 S (All Spans)   |
| Shear (lbs)           | 5908 @ 1' 5"      | 16342        | Passed (36%)   | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Moment (Ft-lbs)       | 31401 @ 9' 3"     | 46854        | Passed (67%)   | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Live Load Defl. (in)  | 0.539 @ 9' 3"     | 0.608        | Passed (L/407) |      | 1.0 D + 1.0 S (All Spans)   |
| Total Load Defl. (in) | 0.833 @ 9' 3"     | 0.913        | Passed (L/263) |      | 1.0 D + 1.0 S (All Spans)   |

System : Wall Member Type : Header Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD

• Deflection criteria: LL (L/360) and TL (L/240).

Allowed moment does not reflect the adjustment for the beam stability factor.

|                  | Bearing Length |           |          | Loads | to Supports |          |             |
|------------------|----------------|-----------|----------|-------|-------------|----------|-------------|
| Supports         | Total          | Available | Required | Dead  | Snow        | Factored | Accessories |
| 1 - Trimmer - DF | 3.00"          | 3.00"     | 2.13"    | 2467  | 4509        | 6977     | None        |
| 2 - Trimmer - DF | 3.00"          | 3.00"     | 2.13"    | 2467  | 4509        | 6977     | None        |

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 18' 6" o/c        |          |
| Bottom Edge (Lu) | 18' 6" o/c        |          |
|                  |                   |          |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads        | Location    | Tributary Width | Dead<br>(0.90) | Snow<br>(1.15) | Comments |
|-----------------------|-------------|-----------------|----------------|----------------|----------|
| 0 - Self Weight (PLF) | 0 to 18' 6" | N/A             | 23.0           |                |          |
| 1 - Uniform (PSF)     | 0 to 18' 6" | 16' 3"          | 15.0           | 30.0           | Snow     |

#### Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

| ForteWEB Software Operator   | Job Notes |
|--|-----------|
| Jane Johnson<br>Bykonen Carter Quinn<br>(206) 264-7784<br>jaj@bcq-se.com |           |





# Roof, Cantilever corner 3 piece(s) 2 x 10 HF No.2

Overall Length: 12' 6"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results        | Actual @ Location | Allowed      | Result          | LDF  | Load: Combination (Pattern) |
|-----------------------|-------------------|--------------|-----------------|------|-----------------------------|
| Member Reaction (lbs) | 2439 @ 4' 1 1/2"  | 5468 (3.00") | Passed (45%)    |      | 1.0 D + 1.0 S (All Spans)   |
| Shear (lbs)           | 1329 @ 3' 2 3/4"  | 4787         | Passed (28%)    | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Moment (Ft-lbs)       | -4997 @ 4' 1 1/2" | 5750         | Passed (87%)    | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Live Load Defl. (in)  | 0.233 @ 0         | 0.275        | Passed (2L/424) |      | 1.0 D + 1.0 S (Alt Spans)   |
| Total Load Defl. (in) | 0.345 @ 0         | 0.412        | Passed (2L/288) |      | 1.0 D + 1.0 S (Alt Spans)   |

System : Wall Member Type : Header Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD

• Deflection criteria: LL (L/360) and TL (L/240).

• Overhang deflection criteria: LL (2L/360) and TL (2L/240).

Allowed moment does not reflect the adjustment for the beam stability factor.

• -306 lbs uplift at support located at 12' 4 1/2". Strapping or other restraint may be required.

Applicable calculations are based on NDS.

|                  | Bearing Length |           |          | Loads | to Supports |          |             |
|------------------|----------------|-----------|----------|-------|-------------|----------|-------------|
| Supports         | Total          | Available | Required | Dead  | Snow        | Factored | Accessories |
| 1 - Trimmer - DF | 3.00"          | 3.00"     | 1.50"    | 879   | 1560        | 2439     | None        |
| 2 - Trimmer - DF | 3.00"          | 3.00"     | 1.50"    | -37   | 57/-269     | 20/-306  | None        |

| Lateral Bracing   | Bracing Intervals | Comments |  |  |  |  |
|---|-------------------|----------|--|--|--|--|
| Top Edge (Lu)   | 12' 6" o/c        |          |  |  |  |  |
| Bottom Edge (Lu)  | 10' 4" o/c        |          |  |  |  |  |
| Manufacture allocated by sector intervals beauting land |                   |          |  |  |  |  |

Maximum allowable bracing intervals based on applied load.

|                       |             |                 | Dead   | Snow   |          |
|-----------------------|-------------|-----------------|--------|--------|----------|
| Vertical Loads        | Location    | Tributary Width | (0.90) | (1.15) | Comments |
| 0 - Self Weight (PLF) | 0 to 12' 6" | N/A             | 10.6   |        |          |
| 1 - Uniform (PSF)     | 0 to 12' 6" | 2'              | 15.0   | 30.0   | Snow     |
| 2 - Point (Ib)        | 0           | N/A             | 335    | 669    |          |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator           | Job Notes |
|--------------------------------------|-----------|
| Jane Johnson<br>Bykonen Carter Quinn |           |
| (206) 264-7784                       |           |
| iai@bcg-se.com                       |           |

Weyerhaeuser





# Upper Floor, 10/ Steel beam 1 piece(s) W10X45 (A992) ASTM Steel

PASSED



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results        | Actual @ Location   | Allowed       | Result         | LDF | Load: Combination (Pattern) |
|-----------------------|---------------------|---------------|----------------|-----|-----------------------------|
| Member Reaction (lbs) | 7268 @ 24' 5 1/2"   | 18647 (3.00") | Passed (39%)   |     | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 7117 @ 24' 4"       | 70700         | Passed (10%)   |     | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 42684 @ 12' 7 1/16" | 92760         | Passed (46%)   |     | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.337 @ 12' 5 1/4"  | 0.605         | Passed (L/862) |     | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.622 @ 12' 5 1/8"  | 1.210         | Passed (L/467) |     | 1.0 D + 1.0 L (All Spans)   |

System : Floor Member Type : Flush Beam Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD

• Deflection criteria: LL (L/480) and TL (L/240).

Applicable calculations are based on ANSI/AISC 360-16.

• A lateral-torsional buckling factor (Сь) of 1.0 has been assumed.

|                               | Bearing Length |                     |             |      | Loads to Su |          |          |             |
|-------------------------------|----------------|---------------------|-------------|------|-------------|----------|----------|-------------|
| Supports                      | Total          | Available           | Required    | Dead | Floor Live  | Seismic  | Factored | Accessories |
| 1 - Hanger on 10 1/8" DF beam | 3.00"          | Hanger <sup>1</sup> | 1.50" / - 2 | 2827 | 3261        | 374/-374 | 6088     | See note 1  |
| 2 - Column - DF               | 3.00"          | 3.00"               | 3.00"       | 3317 | 3952        | 374/-374 | 7268     | Blocking    |

Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger

1 See Connector grid below for additional information and/or requirements.
 2 Required Bearing Length / Required Bearing Length with Web Stiffeners

 Lateral Bracing
 Bracing Intervals
 Comments

 Top Edge (Lu)
 End Bearing Points
 End Bearing Points

 Bottom Edge (Lu)
 End Bearing Points
 End Bearing Points

| Connector: Simpson Strong-Tie  |                     |             |               |                |                  |             |  |  |
|--|---------------------|-------------|---------------|----------------|------------------|-------------|--|--|
| Support  | Model               | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |  |  |
| 1 - Face Mount Hanger  | Connector not found | N/A         | N/A           | N/A            | N/A              |             |  |  |
| - Defer to manufacturer notes and instructions for meaner installation and use of all connectors |                     |             |               |                |                  |             |  |  |

Refer to manufacturer notes and instructions for proper installation and use of all connectors.

|                       |                 |                 | Dead   | Floor Live | Seismic |              |
|-----------------------|-----------------|-----------------|--------|------------|---------|--------------|
| Vertical Loads        | Location (Side) | Tributary Width | (0.90) | (1.00)     | (1.60)  | Comments     |
| 0 - Self Weight (PLF) | 3" to 24' 7"    | N/A             | 45.0   |            |         |              |
| 1 - Uniform (PSF)     | 0 to 5'         | 3' 9"           | 28.0   | 40.0       | -       | Default Load |
| 2 - Uniform (PSF)     | 5' to 24' 7"    | 8' 3"           | 28.0   | 40.0       | -       | Default Load |
| 3 - Point (lb)        | 11'             | N/A             | -      | -          | 1207    |              |
| 4 - Point (lb)        | 18' 6"          | N/A             | -      | -          | -1207   |              |

#### Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator Job Notes Jane Johnson Bykonen Carter Quinn (206) 264-7784 jaj@bcq-se.com



9/23/2022 9:03:07 PM UTC ForteWEB v3.4, Engine: V8.2.2.122, Data: V8.1.3.0 File Name: Steinborn Revisions (Ectypos) Page 5 / 18







All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results        | Actual @ Location | Allowed      | Result          | LDF  | Load: Combination (Pattern) |
|-----------------------|-------------------|--------------|-----------------|------|-----------------------------|
| Member Reaction (lbs) | 4142 @ 7' 6"      | 9568 (4.50") | Passed (43%)    |      | 1.0 D + 1.0 S (All Spans)   |
| Shear (lbs)           | 3937 @ 6' 2 1/2"  | 16342        | Passed (24%)    | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Moment (Ft-lbs)       | 9856 @ 5'         | 46854        | Passed (21%)    | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Live Load Defl. (in)  | 0.029 @ 5'        | 0.181        | Passed (L/999+) |      | 1.0 D + 1.0 S (All Spans)   |
| Total Load Defl. (in) | 0.044 @ 5'        | 0.363        | Passed (L/999+) |      | 1.0 D + 1.0 S (All Spans)   |

System : Floor Member Type : Flush Beam Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD

• Deflection criteria: LL (L/480) and TL (L/240).

|  | B     | earing Leng | th       |      | Loads to Sup |      |          |             |  |  |
|--|-------|-------------|----------|------|--------------|------|----------|-------------|--|--|
| Supports   | Total | Available   | Required | Dead | Floor Live   | Snow | Factored | Accessories |  |  |
| 1 - Stud wall - HF   | 4.50" | 4.50"       | 1.50"    | 919  | 207          | 1505 | 2424     | Blocking    |  |  |
| 2 - Stud wall - HF   | 4.50" | 4.50"       | 1.95"    | 1492 | 207          | 2650 | 4142     | Blocking    |  |  |
| Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed. |       |             |          |      |              |      |          |             |  |  |

| Lateral Bracing  | Bracing Intervals  | Comments |
|------------------|--------------------|----------|
| Top Edge (Lu)    | Continuous         |          |
| Bottom Edge (Lu) | End Bearing Points |          |

|                       |                    |                 | Dead   | Floor Live | Snow   |               |
|-----------------------|--------------------|-----------------|--------|------------|--------|---------------|
| Vertical Loads        | Location (Side)    | Tributary Width | (0.90) | (1.00)     | (1.15) | Comments      |
| 0 - Self Weight (PLF) | 0 to 7' 9"         | N/A             | 23.0   |            |        |               |
| 1 - Uniform (PSF)     | 0 to 7' 9" (Front) | 1' 4"           | 15.0   | 40.0       | -      | Default Load  |
| 2 - Uniform (PSF)     | 0 to 7' 9" (Top)   | 2'              | 15.0   | -          | 30.0   |               |
| 3 - Point (Ib)        | 5' (Front)         | N/A             | 1845   | -          | 3690   | Low roof beam |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator           | Job Notes |
|--------------------------------------|-----------|
| Jane Johnson<br>Rykonen Carter Quinn |           |
| (206) 264-7784                       |           |
| jaj@bcq-se.com                       |           |



9/23/2022 9:03:07 PM UTC ForteWEB v3.4, Engine: V8.2.2.122, Data: V8.1.3.0 File Name: Steinborn Revisions (Ectypos) Page 6 / 18

# 

#### MEMBER REPORT

Upper Floor, 16/ Beam at hold-down - omega



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results        | Actual @ Location   | Allowed      | Result         |   | LDF  | Load: Combination (Pattern) |
|-----------------------|---------------------|--------------|----------------|---|------|-----------------------------|
| Member Reaction (lbs) | 2556 @ 17' 2 1/2"   | 4725 (1.50") | Passed (54%)   |   |      | 1.0 D + 0.7 E (All Spans)   |
| Shear (lbs)           | 7364 @ 1' 7 1/2"    | 16203        | Passed (45%)   |   | 1.60 | 1.0 D + 0.7 E (All Spans)   |
| Moment (Ft-lbs)       | 28705 @ 4' 3"       | 34944        | Passed (82%)   | 1 | 1.60 | 1.0 D + 0.7 E (All Spans)   |
| Live Load Defl. (in)  | -0.895 @ 7' 9"      | 0.422        | Failed (L/226) |   |      | 0.6 D - 0.7 E (All Spans)   |
| Total Load Defl. (in) | 0.977 @ 7' 9 15/16" | 0.844        | Failed (L/207) |   |      | 1.0 D + 0.7 E (All Spans)   |

System : Floor Member Type : Flush Beam Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD

• Deflection criteria: LL (L/480) and TL (L/240).

• Allowed moment does not reflect the adjustment for the beam stability factor.

|                                  | В     | earing Leng         | th       |      | Loads to Su |            |                |             |
|----------------------------------|-------|---------------------|----------|------|-------------|------------|----------------|-------------|
| Supports                         | Total | Available           | Required | Dead | Floor Live  | Seismic    | Factored       | Accessories |
| 1 - Column Cap - steel           | 5.50" | 5.50"               | 2.36"    | 462  | 468         | 9983/-9983 | 7450/-<br>6711 | Blocking    |
| 2 - Hanger on Single 2X HF plate | 3.00" | Hanger <sup>1</sup> | 1.50"    | 454  | 463         | 3017/-3017 | 2566/-<br>1840 | See note 1  |

Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

• At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger

• <sup>1</sup> See Connector grid below for additional information and/or requirements.

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 9' 1" o/c         |          |
| Bottom Edge (Lu) | 10' 9" o/c        |          |
|                  |                   |          |

•Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-T | īe                  |             |               |                |                  |             |
|-----------------------------|---------------------|-------------|---------------|----------------|------------------|-------------|
| Support                     | Model               | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
| 2 - Top Mount Hanger        | Connector not found | N/A         | N/A           | N/A            | N/A              |             |
|                             |                     |             |               |                |                  |             |

• Refer to manufacturer notes and instructions for proper installation and use of all connectors.

|                       |                         |                 | Dead   | Floor Live | Seismic |              |
|-----------------------|-------------------------|-----------------|--------|------------|---------|--------------|
| Vertical Loads        | Location (Side)         | Tributary Width | (0.90) | (1.00)     | (1.60)  | Comments     |
| 0 - Self Weight (PLF) | 0 to 17' 2 1/2"         | N/A             | 15.3   |            |         |              |
| 1 - Uniform (PSF)     | 0 to 17' 5 1/2" (Front) | 1' 4"           | 28.0   | 40.0       | -       | Default Load |
| 2 - Point (lb)        | 4' 3" (Front)           | N/A             | -      | -          | 13000   | Omega=2.5    |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator   | Job Notes |
|--|-----------|
| Jane Johnson<br>Bykonen Carter Quinn<br>(206) 264-7784<br>jaj@bcq-se.com |           |



9/23/2022 9:03:07 PM UTC ForteWEB v3.4, Engine: V8.2.2.122, Data: V8.1.3.0 File Name: Steinborn Revisions (Ectypos) Page 8 / 18





All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results        | Actual @ Location | Allowed      | Result         | LDF  | Load: Combination (Pattern) |
|-----------------------|-------------------|--------------|----------------|------|-----------------------------|
| Member Reaction (lbs) | 4116 @ 2"         | 4961 (3.50") | Passed (83%)   |      | 1.0 D + 1.0 S (All Spans)   |
| Shear (lbs)           | 3278 @ 1' 3 3/8"  | 9241         | Passed (35%)   | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Moment (Ft-Ibs)       | 12272 @ 6' 3 1/2" | 22888        | Passed (54%)   | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Live Load Defl. (in)  | 0.244 @ 6' 3 1/2" | 0.613        | Passed (L/603) |      | 1.0 D + 1.0 S (All Spans)   |
| Total Load Defl. (in) | 0.373 @ 6' 3 1/2" | 0.817        | Passed (L/394) |      | 1.0 D + 1.0 S (All Spans)   |

System : Roof Member Type : Drop Beam Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD Member Pitch : 0/12

• Deflection criteria: LL (L/240) and TL (L/180).

• Allowed moment does not reflect the adjustment for the beam stability factor.

|  | Bearing Length |                |               | Loads           | to Supports   |              |             |
|--|----------------|----------------|---------------|-----------------|---------------|--------------|-------------|
| Supports                                     | Total          | Available      | Required      | Dead            | Snow          | Factored     | Accessories |
| 1 - Stud wall - HF                           | 3.50"          | 3.50"          | 2.90"         | 1426            | 2690          | 4116         | Blocking    |
| 2 - Stud wall - HF                           | 3.50"          | 3.50"          | 2.90"         | 1426            | 2690          | 4116         | Blocking    |
| Blocking Papels are assumed to carry no load | c applied dire | ctly above the | m and the ful | l load is appli | ed to the mer | nhor hoing d | lecianed    |

Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 12' 7" o/c        |          |
| Bottom Edge (Lu) | 12' 7" o/c        |          |

•Maximum allowable bracing intervals based on applied load.

|                       |                     |                 | Dead   | Snow   |              |
|-----------------------|---------------------|-----------------|--------|--------|--------------|
| Vertical Loads        | Location (Side)     | Tributary Width | (0.90) | (1.15) | Comments     |
| 0 - Self Weight (PLF) | 0 to 12' 7"         | N/A             | 13.0   |        |              |
| 1 - Uniform (PSF)     | 0 to 12' 7" (Front) | 14' 3"          | 15.0   | 30.0   | Default Load |

#### Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

| ForteWEB Software Operator   | Job Notes |
|--|-----------|
| Jane Johnson<br>Bykonen Carter Quinn<br>(206) 264-7784<br>Jaj@bcq-se.com |           |





## Upper Floor, 18/ Roof Beam 1 piece(s) 7" x 11 7/8" 2.0E Parallam® PSL



Overall Length: 18' 1"

All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results        | Actual @ Location | Allowed      | Result         | LDF  | Load: Combination (Pattern) |
|-----------------------|-------------------|--------------|----------------|------|-----------------------------|
| Member Reaction (lbs) | 6033 @ 2"         | 9923 (3.50") | Passed (61%)   |      | 1.0 D + 1.0 S (All Spans)   |
| Shear (lbs)           | 5178 @ 1' 3 3/8"  | 18481        | Passed (28%)   | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Moment (Ft-lbs)       | 26279 @ 9' 1/2"   | 45776        | Passed (57%)   | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Live Load Defl. (in)  | 0.512 @ 9' 1/2"   | 0.887        | Passed (L/416) |      | 1.0 D + 1.0 S (All Spans)   |
| Total Load Defl. (in) | 0.799 @ 9' 1/2"   | 1.183        | Passed (L/266) |      | 1.0 D + 1.0 S (All Spans)   |

System : Roof Member Type : Drop Beam Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD Member Pitch : 0/12

• Deflection criteria: LL (L/240) and TL (L/180).

• Allowed moment does not reflect the adjustment for the beam stability factor.

0

• Member should be side-loaded from both sides of the member or braced to prevent rotation.

|  | Bearing Length |                |               | Loads to Supports (lbs) |               |              |             |
|--|----------------|----------------|---------------|-------------------------|---------------|--------------|-------------|
| Supports   | Total          | Available      | Required      | Dead                    | Snow          | Factored     | Accessories |
| 1 - Stud wall - HF   | 3.50"          | 3.50"          | 2.13"         | 2168                    | 3865          | 6033         | Blocking    |
| 2 - Stud wall - HF   | 3.50"          | 3.50"          | 2.13"         | 2168                    | 3865          | 6033         | Blocking    |
| <ul> <li>Blocking Panels are assumed to carry no load</li> </ul> | s applied dire | ctly above the | m and the ful | load is appli           | ed to the mer | nber beina d | esianed.    |

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 18' 1" o/c        |          |
| Bottom Edge (Lu) | 18' 1" o/c        |          |

•Maximum allowable bracing intervals based on applied load.

|                       |                     |                 | Dead   | Snow   |              |
|-----------------------|---------------------|-----------------|--------|--------|--------------|
| Vertical Loads        | Location (Side)     | Tributary Width | (0.90) | (1.15) | Comments     |
| 0 - Self Weight (PLF) | 0 to 18' 1"         | N/A             | 26.0   |        |              |
| 1 - Uniform (PSF)     | 0 to 18' 1" (Front) | 14' 3"          | 15.0   | 30.0   | Default Load |

#### Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

| ForteWEB Software Operator   | Job Notes |
|--|-----------|
| Jane Johnson<br>Bykonen Carter Quinn<br>(206) 264-7784<br>jaj@bcq-se.com |           |





# Upper Floor, 19/ Cantilever corner 3 piece(s) 2 x 10 HF No.2

#### Overall Length: 12' 6"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results        | Actual @ Location | Allowed      | Result          | LDF  | Load: Combination (Pattern) |
|-----------------------|-------------------|--------------|-----------------|------|-----------------------------|
| Member Reaction (lbs) | 4544 @ 4' 1 1/2"  | 5468 (3.00") | Passed (83%)    |      | 1.0 D + 1.0 S (All Spans)   |
| Shear (lbs)           | 2052 @ 5' 1/4"    | 4787         | Passed (43%)    | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Moment (Ft-lbs)       | -4661 @ 4' 1 1/2" | 5750         | Passed (81%)    | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Live Load Defl. (in)  | 0.151 @ 0         | 0.275        | Passed (2L/654) |      | 1.0 D + 1.0 S (Alt Spans)   |
| Total Load Defl. (in) | 0.196 @ 0         | 0.412        | Passed (2L/504) |      | 1.0 D + 1.0 S (Alt Spans)   |

System : Wall Member Type : Header Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD

• Deflection criteria: LL (L/360) and TL (L/240).

Overhang deflection criteria: LL (2L/360) and TL (2L/240).

• Allowed moment does not reflect the adjustment for the beam stability factor.

• Applicable calculations are based on NDS.

|                  | Bearing Length |           |          | Loads to Supports (lbs) |      |          |             |
|------------------|----------------|-----------|----------|-------------------------|------|----------|-------------|
| Supports         | Total          | Available | Required | Dead                    | Snow | Factored | Accessories |
| 1 - Trimmer - DF | 3.00"          | 3.00"     | 2.49"    | 1580                    | 2964 | 4544     | None        |
| 2 - Trimmer - DF | 3.00"          | 3.00"     | 1.50"    | 487                     | 1090 | 1577     | None        |

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 12' 6" o/c        |          |
| Bottom Edge (Lu) | 12' 3" o/c        |          |

•Maximum allowable bracing intervals based on applied load.

|                       |             |                 | Dead   | Snow   |          |
|-----------------------|-------------|-----------------|--------|--------|----------|
| Vertical Loads        | Location    | Tributary Width | (0.90) | (1.15) | Comments |
| 0 - Self Weight (PLF) | 0 to 12' 6" | N/A             | 10.6   |        |          |
| 1 - Uniform (PSF)     | 0 to 12' 6" | 10'             | 15.0   | 30.0   | Snow     |
| 2 - Point (Ib)        | 0           | N/A             | 60     | 120    |          |

#### Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

| ForteWEB Software Operator | Job Notes |
|----------------------------|-----------|
| Jane Johnson               |           |
| Bykonen Carter Quinn       |           |
| (206) 264-7784             |           |
| jaj@bcq-se.com             |           |





# Upper Floor, Low roof 3ft cantilever 2 piece(s) 2 x 4 HF No.2 @ 24" OC

Sloped Length: 10' 1 1/4"



LDF

1.15

1.15

All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Load: Combination (Pattern)

1.0 D + 1.0 S (All Spans)

1.0 D + 1.0 S (All Spans)

1.0 D + 1.0 S (All Spans)

1.0 D + 1.0 S (Alt Spans)

1.0 D + 1.0 S (Alt Spans)

Member Length : 10' 2 3/8"

System : Roof Member Type : Joist Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD Member Pitch : 4/12

 Total Load Defl. (in)
 0

 • Deflection criteria: LL (L/240) and TL (L/180)

**Design Results** 

Shear (lbs)

Moment (Ft-lbs)

Live Load Defl. (in)

Member Reaction (lbs)

• Overhang deflection criteria: LL (2L/240) and TL (2L/180).

• Allowed moment does not reflect the adjustment for the beam stability factor.

• A 15% increase in the moment capacity has been added to account for repetitive member usage.

Actual @ Location

576 @ 3' 1 3/4"

285 @ 3' 6 13/16"

-404 @ 3' 1 3/4"

0.198 @ 0

0.254 @ 0

• Applicable calculations are based on NDS.

|   | Bearing Length |           |          | Loads | to Supports |          |             |
|---|----------------|-----------|----------|-------|-------------|----------|-------------|
| Supports  | Total          | Available | Required | Dead  | Snow        | Factored | Accessories |
| 1 - Beveled Plate - SPF   | 3.50"          | 3.50"     | 1.50"    | 223   | 353         | 576      | Blocking    |
| 2 - Beveled Plate - SPF   | 3.50"          | 3.50"     | 1.50"    | 80    | 146         | 226      | Blocking    |
| - Reading Danals are assumed to save up loads applied directly above them and the full load is applied to the member being designed |                |           |          |       |             |          |             |

Allowed

4483 (3.50")

1208

861

0.332

0.442

Result

Passed (13%)

Passed (24%)

Passed (47%)

Passed (2L/402)

Passed (2L/314)

Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing  | Bracing Intervals | Comments |  |  |  |  |
|------------------|-------------------|----------|--|--|--|--|
| Top Edge (Lu)    | 10' 1" o/c        |          |  |  |  |  |
| Bottom Edge (Lu) | 10' 1" o/c        |          |  |  |  |  |
|                  |                   |          |  |  |  |  |

•Maximum allowable bracing intervals based on applied load.

|                   |                 |         | Dead   | Snow   |              |
|-------------------|-----------------|---------|--------|--------|--------------|
| Vertical Load     | Location (Side) | Spacing | (0.90) | (1.15) | Comments     |
| 1 - Uniform (PSF) | 0 to 9' 7"      | 24"     | 15.0   | 25.0   | Default Load |

#### Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

| ForteWEB Software Operator   | Job Notes |
|--|-----------|
| Jane Johnson<br>Bykonen Carter Quinn<br>(206) 264-7784<br>jaj@bcq-se.com |           |







# Main Floor, Floor: Joist - 24'-1" span 2 piece(s) 14" TJI ® 560 @ 16" OC





All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results             | Actual @ Location | Allowed      | Result          | LDF  | Load: Combination (Pattern) |
|----------------------------|-------------------|--------------|-----------------|------|-----------------------------|
| Member Reaction (lbs)      | 1118 @ 2 1/2"     | 3450 (3.50") | Passed (32%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)                | 1092 @ 3 1/2"     | 4780         | Passed (23%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-Ibs)            | 6665 @ 12' 4"     | 22550        | Passed (30%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)       | 0.235 @ 12' 4"    | 0.606        | Passed (L/999+) |      | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in)      | 0.399 @ 12' 4"    | 1.212        | Passed (L/729)  |      | 1.0 D + 1.0 L (All Spans)   |
| TJ-Pro <sup>™</sup> Rating | 47                | 45           | Passed          |      |                             |

System : Floor Member Type : Joist Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD

Deflection criteria: LL (L/480) and TL (L/240).

· Allowed moment does not reflect the adjustment for the beam stability factor.

• A structural analysis of the deck has not been performed.

• Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.

• Additional considerations for the TJ-Pro<sup>™</sup> Rating include: Perpendicular Partitions, Pour Flooring Overlay.

|                    | Bearing Length |           |          | Loads | to Supports |          |             |
|--------------------|----------------|-----------|----------|-------|-------------|----------|-------------|
| Supports           | Total          | Available | Required | Dead  | Floor Live  | Factored | Accessories |
| 1 - Stud wall - HF | 3.50"          | 3.50"     | 1.75"    | 460   | 658         | 1118     | Blocking    |
| 2 - Beam - HF      | 3.50"          | 3.50"     | 1.75"    | 460   | 658         | 1118     | Blocking    |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 10' 9" o/c        |          |
| Bottom Edge (Lu) | 24' 8" o/c        |          |
|                  |                   |          |

TJI joists are only analyzed using Maximum Allowable bracing solutions.

•Maximum allowable bracing intervals based on applied load.

|                   |             |         | Dead   | Floor Live |          |
|-------------------|-------------|---------|--------|------------|----------|
| Vertical Load     | Location    | Spacing | (0.90) | (1.00)     | Comments |
| 1 - Uniform (PSF) | 0 to 24' 8" | 16"     | 28.0   | 40.0       | 1.5" gyp |

#### Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator J Jane Johnson Bykonen Carter Quinn (206) 264-7784 Jaj@bcq-se.com

Job Notes





# Main Floor, 11/Steel Beam 1 piece(s) W14X61 (A992) ASTM Steel

Overall Length: 25' 2 1/2"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results        | Actual @ Location   | Allowed       | Result         | LDF | Load: Combination (Pattern)         |
|-----------------------|---------------------|---------------|----------------|-----|-------------------------------------|
| Member Reaction (lbs) | 14290 @ 24' 10 1/2" | 22275 (5.50") | Passed (64%)   |     | 1.0 D + 1.0 L (All Spans)           |
| Shear (lbs)           | 18029 @ 3"          | 104250        | Passed (17%)   |     | 1.0 D + 1.0 L (All Spans)           |
| Moment (Ft-Ibs)       | 113662 @ 10' 6"     | 175156        | Passed (65%)   |     | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Live Load Defl. (in)  | 0.301 @ 12' 2 1/4"  | 0.616         | Passed (L/980) |     | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Total Load Defl. (in) | 0.631 @ 12' 3 1/16" | 1.231         | Passed (L/468) |     | 1.0 D + 0.75 L + 0.75 S (All Spans) |

System : Floor Member Type : Flush Beam Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD

Deflection criteria: LL (L/480) and TL (L/240).

• Bearing reinforcement may be required for support located at 0".

• Applicable calculations are based on ANSI/AISC 360-16.

• A lateral-torsional buckling factor (Сь) of 1.0 has been assumed.

|                               | Bearing Length |                     |             | Loads to Supports (lbs) |            |           |      |          |             |
|-------------------------------|----------------|---------------------|-------------|-------------------------|------------|-----------|------|----------|-------------|
| Supports                      | Total          | Available           | Required    | Dead                    | Floor Live | Roof Live | Snow | Factored | Accessories |
| 1 - Hanger on 13 7/8" HF beam | 3.00"          | Hanger <sup>1</sup> | 1.50" / - 2 | 9254                    | 9078       | 754       | 2256 | 18332    | See note 1  |
| 2 - Stud wall - HF            | 5.50"          | 5.50"               | 5.50"       | 7710                    | 6580       | 759       | 1609 | 14290    | Blocking    |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

• At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger

• <sup>1</sup> See Connector grid below for additional information and/or requirements.

• <sup>2</sup> Required Bearing Length / Required Bearing Length with Web Stiffeners

| Lateral Bracing  | Bracing Intervals  | Comments |
|------------------|--------------------|----------|
| Top Edge (Lu)    | End Bearing Points |          |
| Bottom Edge (Lu) | End Bearing Points |          |

## Connector: Simpson Strong-Tie

| 1 5                   |                     |             |                              |     |                  |             |
|-----------------------|---------------------|-------------|------------------------------|-----|------------------|-------------|
| Support               | Model               | Seat Length | Top Fasteners Face Fasteners |     | Member Fasteners | Accessories |
| 1 - Face Mount Hanger | Connector not found | N/A         | N/A                          | N/A | N/A              |             |
|                       |                     |             |                              |     |                  |             |

• Refer to manufacturer notes and instructions for proper installation and use of all connectors.

|                       |                      |                 | Dead   | Floor Live | Roof Live        | Snow   |   |
|-----------------------|----------------------|-----------------|--------|------------|------------------|--------|---|
| Vertical Loads        | Location (Side)      | Tributary Width | (0.90) | (1.00)     | (non-snow: 1.25) | (1.15) | Comments                                    |
| 0 - Self Weight (PLF) | 3" to 25' 2 1/2"     | N/A             | 61.0   |            |                  |        |   |
| 1 - Uniform (PSF)     | 0 to 12' 6"          | 9'              | 28.0   | 40.0       | -                | -      | Floor                                       |
| 2 - Uniform (PSF)     | 12' 6" to 25' 2 1/2" | 6' 6"           | 28.0   | 40.0       | -                | -      | Floor                                       |
| 3 - Tapered (PSF)     | 0 to 7'              | 5' to 9'        | 25.0   | 60.0       | -                | -      | Deck  |
| 4 - Tapered (PSF)     | 7' to 25' 2 1/2"     | 9' to 0         | 25.0   | 60.0       | -                | -      | Deck  |
| 5 - Uniform (PLF)     | 0 to 25' 2 1/2"      | N/A             | 150.0  | -          | -                | -      | Wall weight                                 |
| 6 - Uniform (PSF)     | 0 to 25' 2 1/2"      | 2'              | 15.0   | -          | 30.0             | -      | Roof  |
| 7 - Point (Ib)        | 10' 6"               | N/A             | 2168   | -          | -                | 3865   | Linked from: 18/<br>Roof Beam, Support<br>1 |

| ForteWEB Software Operator   | Job Notes |
|--|-----------|
| Jane Johnson<br>Bykonen Carter Quinn<br>(206) 264-7784<br>jaj@bcq-se.com |           |



9/23/2022 9:03:07 PM UTC ForteWEB v3.4, Engine: V8.2.2.122, Data: V8.1.3.0 File Name: Steinborn Revisions (Ectypos) Page 14 / 18

# Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator Jane Johnson Bykonen Carter Quinn (206) 264-7784 jaj@bcq-se.com Job Notes



9/23/2022 9:03:07 PM UTC ForteWEB v3.4, Engine: V8.2.2.122, Data: V8.1.3.0 File Name: Steinborn Revisions (Ectypos) Page 15 / 18



# Main Floor, 17/Deck Beam 1 piece(s) 5 1/4" x 14" 2.0E Parallam® PSL



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results        | Actual @ Location | Allowed      | Result          | LDF  | Load: Combination (Pattern)          |
|-----------------------|-------------------|--------------|-----------------|------|--------------------------------------|
| Member Reaction (lbs) | 5681 @ 1 1/2"     | 6379 (3.00") | Passed (89%)    |      | 1.0 D + 0.75 L + 0.75 Lr (All Spans) |
| Shear (lbs)           | 3629 @ 1' 5"      | 14210        | Passed (26%)    | 1.00 | 1.0 D + 1.0 L (All Spans)            |
| Moment (Ft-lbs)       | 14508 @ 6' 6"     | 40743        | Passed (36%)    | 1.00 | 1.0 D + 1.0 L (All Spans)            |
| Live Load Defl. (in)  | 0.117 @ 6' 6"     | 0.319        | Passed (L/999+) |      | 1.0 D + 0.75 L + 0.75 Lr (All Spans) |
| Total Load Defl. (in) | 0.244 @ 6' 6"     | 0.637        | Passed (L/626)  |      | 1.0 D + 0.75 L + 0.75 Lr (All Spans) |

System : Floor Member Type : Flush Beam Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD

• Deflection criteria: LL (L/480) and TL (L/240).

Allowed moment does not reflect the adjustment for the beam stability factor.

|   | Bearing Length |           |          | Loads to Supports (lbs) |            |           |          |             |  |
|---|----------------|-----------|----------|-------------------------|------------|-----------|----------|-------------|--|
| Supports  | Total          | Available | Required | Dead                    | Floor Live | Roof Live | Factored | Accessories |  |
| 1 - Stud wall - HF  | 3.00"          | 3.00"     | 2.67"    | 2951                    | 1690       | 1950      | 5681     | Blocking    |  |
| 2 - Stud wall - HF  | 3.00"          | 3.00"     | 2.67"    | 2951                    | 1690       | 1950      | 5681     | Blocking    |  |
| Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed |                |           |          |                         |            |           |          |             |  |

carry no loads applied directly above them and the full load is applied to the member being desig

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 13' o/c           |          |
| Bottom Edge (Lu) | 13' o/c           |          |

•Maximum allowable bracing intervals based on applied load.

|                       |                  |                 | Dead   | Floor Live | Roof Live        |          |
|-----------------------|------------------|-----------------|--------|------------|------------------|----------|
| Vertical Loads        | Location (Side)  | Tributary Width | (0.90) | (1.00)     | (non-snow: 1.25) | Comments |
| 0 - Self Weight (PLF) | 0 to 13'         | N/A             | 23.0   |            |                  |          |
| 1 - Uniform (PSF)     | 0 to 13' (Front) | 2'              | 28.0   | 40.0       | -                | Floor    |
| 2 - Uniform (PSF)     | 0 to 13' (Front) | 3'              | 25.0   | 60.0       | -                | Deck     |
| 3 - Uniform (PSF)     | 0 to 13' (Front) | 10'             | 15.0   | -          | 30.0             | Roof     |
| 4 - Uniform (PLF)     | 0 to 13' (Front) | N/A             | 150.0  | -          | -                | Wall wt  |

#### Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job |
|----------------------------|-----|
| Jane Johnson               |     |
| Bykonen Carter Quinn       |     |
| (206) 264-7784             |     |
| iai@hcg.se.com             |     |

Notes





# Main Floor, 18/ Platform Beam 1 piece(s) 4 x 12 HF No.1

#### Overall Length: 9' 1"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results        | Actual @ Location | Allowed      | Result          | LDF  | Load: Combination (Pattern) |
|-----------------------|-------------------|--------------|-----------------|------|-----------------------------|
| Member Reaction (lbs) | 3427 @ 1' 1 3/4"  | 4961 (3.50") | Passed (69%)    |      | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 1934 @ 2' 2 3/4"  | 3938         | Passed (49%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 4995 @ 5' 11/16"  | 6477         | Passed (77%)    | 1.00 | 1.0 D + 1.0 L (Alt Spans)   |
| Live Load Defl. (in)  | 0.063 @ 5' 3/8"   | 0.259        | Passed (L/999+) |      | 1.0 D + 1.0 L (Alt Spans)   |
| Total Load Defl. (in) | 0.087 @ 5' 7/16"  | 0.389        | Passed (L/999+) |      | 1.0 D + 1.0 L (Alt Spans)   |

System : Floor Member Type : Drop Beam Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD

• Deflection criteria: LL (L/360) and TL (L/240).

Overhang deflection criteria: LL (2L/360) and TL (2L/240).

• A 1.8% decrease in the moment capacity has been added to account for lateral stability.

• Applicable calculations are based on NDS.

|                    | Bearing Length |           |          | Loads to Supports (lbs) |            |          |             |
|--------------------|----------------|-----------|----------|-------------------------|------------|----------|-------------|
| Supports           | Total          | Available | Required | Dead                    | Floor Live | Factored | Accessories |
| 1 - Column - HF    | 3.50"          | 3.50"     | 2.42"    | 972                     | 2456       | 3427     | Blocking    |
| 2 - Stud wall - HF | 3.50"          | 3.50"     | 1.90"    | 754                     | 1945/-41   | 2699     | Blocking    |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing  | Bracing Intervals  | Comments |
|------------------|--------------------|----------|
| Top Edge (Lu)    | End Bearing Points |          |
| Bottom Edge (Lu) | End Bearing Points |          |

|                       |                    |                 | Dead   | Floor Live |              |
|-----------------------|--------------------|-----------------|--------|------------|--------------|
| Vertical Loads        | Location (Side)    | Tributary Width | (0.90) | (1.00)     | Comments     |
| 0 - Self Weight (PLF) | 0 to 9' 1"         | N/A             | 10.0   |            |              |
| 1 - Uniform (PSF)     | 0 to 9' 1" (Front) | 12'             | 15.0   | 40.0       | Default Load |

#### Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

| F             | orteWEB Software Operator   | Job Notes |
|---------------|---|-----------|
| Ja<br>B<br>(2 | ane Johnson<br>ykonen Carter Quinn<br>206) 264-7784<br>uj@hcr.se. com |           |




MEMBER REPORT

## Main Floor, Platform Joist 1 piece(s) 2 x 10 HF No.2 @ 16" OC

Overall Length: 12' 7"



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results             | Actual @ Location | Allowed      | Result         | LDF  | Load: Combination (Pattern) |
|----------------------------|-------------------|--------------|----------------|------|-----------------------------|
| Member Reaction (lbs)      | 461 @ 2 1/2"      | 2126 (3.50") | Passed (22%)   |      | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)                | 383 @ 1' 3/4"     | 1388         | Passed (28%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)            | 1357 @ 6' 3 1/2"  | 1917         | Passed (71%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)       | 0.204 @ 6' 3 1/2" | 0.304        | Passed (L/714) |      | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in)      | 0.281 @ 6' 3 1/2" | 0.608        | Passed (L/519) |      | 1.0 D + 1.0 L (All Spans)   |
| TJ-Pro <sup>™</sup> Rating | N/A               | N/A          | N/A            |      | N/A                         |

System : Floor Member Type : Joist Building Use : Residential Building Code : IBC 2018 Design Methodology : ASD

• Deflection criteria: LL (L/480) and TL (L/240).

Allowed moment does not reflect the adjustment for the beam stability factor.

• A 15% increase in the moment capacity has been added to account for repetitive member usage.

• Applicable calculations are based on NDS.

· No composite action between deck and joist was considered in analysis.

|                    | В     | earing Leng | th       | Loads | to Supports | s (Ibs)  |             |
|--------------------|-------|-------------|----------|-------|-------------|----------|-------------|
| Supports           | Total | Available   | Required | Dead  | Floor Live  | Factored | Accessories |
| 1 - Stud wall - HF | 3.50" | 3.50"       | 1.50"    | 126   | 336         | 461      | Blocking    |
| 2 - Beam - HF      | 3.50" | 3.50"       | 1.50"    | 126   | 336         | 461      | Blocking    |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Lateral Bracing                  | Bracing Intervals          | Comments |
|----------------------------------|----------------------------|----------|
| Top Edge (Lu)                    | 6' 10" o/c                 |          |
| Bottom Edge (Lu)                 | 12' 7" o/c                 |          |
| -Maximum allowable brasing inter | isle based on applied lead |          |

Maximum allowable bracing intervals based on applied load.

|                   |                 |         | Dead   | Floor Live |              |
|-------------------|-----------------|---------|--------|------------|--------------|
| Vertical Load     | Location (Side) | Spacing | (0.90) | (1.00)     | Comments     |
| 1 - Uniform (PSF) | 0 to 12' 7"     | 16"     | 15.0   | 40.0       | Default Load |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator | Job Notes |
|----------------------------|-----------|
| Jane Johnson               |           |
| Bykonen Carter Quinn       |           |
| (206) 264-7784             |           |
| iai@bcg-se.com             |           |



| MASSING             |            | -              | Ur                 | niform Loads (P | SF)                       |                     | Area (SF)      |                | Σw (k)               | -          |               |                    |          |
|---------------------|------------|----------------|--------------------|-----------------|---------------------------|---------------------|----------------|----------------|----------------------|------------|---------------|--------------------|----------|
| ROOF                |            | Misc           | Partitions         |                 |                           |                     |                |                |                      |            |               |                    |          |
|                     |            | 15             | 6.5                |                 |                           |                     | 1385           |                | 29.8                 |            |               |                    |          |
|                     | l          |                |                    |                 |                           |                     |                |                |                      |            |               |                    |          |
|                     |            |                |                    |                 |                           |                     |                |                |                      |            |               |                    |          |
|                     |            |                | Ur                 | niform Loads (P | SF)                       |                     | Area (SF)      | Green Roof (k) | Σw (k)               | -          |               |                    |          |
| FLOORS              |            | Misc           | Partitions         | Gyp top         |                           |                     |                |                |                      |            |               |                    |          |
|                     | UPPER      | 15             | 13                 | 13              |                           |                     | 1522           | 0.0            | 62.4                 |            |               |                    |          |
|                     | MAIN       | 15             | 13                 | 13              |                           |                     | 1804           |                | 74.0                 |            |               |                    |          |
|                     |            |                |                    |                 |                           |                     |                |                |                      |            |               |                    |          |
| SEISMIC             |            |                |                    |                 |                           |                     |                |                |                      |            |               |                    |          |
| DESIGN PARAMET      | ERS        |                | Site Class =       | D               | <b>S</b> <sub>S</sub> = : | 1.439               |                |                |                      |            |               |                    |          |
|                     |            |                | Risk Cat. =        | П               | S <sub>1</sub> = (        | 0.500               |                |                |                      |            |               |                    |          |
|                     |            |                | S <sub>DS</sub> =  | 0.959           | f <sub>a</sub> = :        | 1.00                |                |                |                      |            |               |                    |          |
|                     |            |                | R =                | 6.50            | f <sub>v</sub> = 3        | 1.80                |                |                |                      |            |               |                    |          |
|                     |            |                | Cs =               | 0.148           | k = 3                     | 1.0                 |                |                |                      |            |               |                    |          |
| ASCE 7-16 Equivale  | ent Latera | al Force Prceo | dure, 12.8         |                 |                           |                     |                |                |                      |            |               |                    | ASD      |
| Level               |            | Area (SF)      | Unit DL (PSF)      | w (k)           |                           | h <sup>k</sup> (ft) |                |                | (w)(h <sup>k</sup> ) |            | Cvx           | F <sub>x</sub> (k) | 0.7E (k) |
| ROOF                |            | 1385           | 21.5               | 29.8            |                           | 30.0                |                |                | 893                  |            | 32%           | 7.9                | 5.5      |
| UPPER               |            | 1522           | 41.0               | 62.4            |                           | 19.2                |                |                | 1196                 |            | 43%           | 10.6               | 7.4      |
| MAIN                |            | 1522           | 41.0               | 74.0            |                           | 9.2                 |                |                | 678                  |            | 25%           | 6.0                | 4.2      |
| Σ                   |            |                |                    | 166.1           | 24.5                      |                     |                |                | 2768                 |            | 100%          |                    |          |
| Base Shear          |            |                |                    |                 |                           |                     |                |                |                      |            |               | 24.5               |          |
|                     |            |                |                    |                 |                           |                     |                |                |                      |            |               |                    |          |
| WIND                |            |                | V (mph) =          | 97              | G =                       | 0.85                | L/B =          | 0.57           |                      | L/B =      | 1.76          |                    |          |
| DESIGN PARAMET      | ERS        |                | Exposure Cat. =    | С               | Gcpi =                    | 0.18                | Cp =           | Windward Wall  | 0.80                 | Cp =       | Windward Wall | 0.80               |          |
|                     |            |                | K <sub>zt</sub> =  | 1.60            | K <sub>z</sub> =          | 0.98                |                | Leeward Wall   | -0.50                |            | Leeward Wall  | -0.35              |          |
|                     |            |                | K <sub>d</sub> =   | 0.85            | q <sub>z</sub> =          | 32.1                |                | Side Wall      | -0.70                |            | Side Wall     | -0.70              |          |
|                     |            | Roc            | of Slope (in/ft) = | 1:12            |                           |                     | h/L=           | 1.23           |                      | h/L=       | 0.70          |                    |          |
|                     |            |                |                    |                 |                           |                     |                | Roof           | -1.30                | -0.18      | Roof          | -0.90              | -0.18    |
| ASCE 7-16 MWFRS     | Direction  | nal Procedure  | e 27.3.1           |                 |                           |                     |                |                |                      |            |               |                    | ASD      |
| ROOF                |            |                | h (ft)             | Direction       |                           | Wall Area           | K <sub>h</sub> | q <sub>h</sub> | Wall (PSF)           | Roof (PSF) | Roof (k)      | F <sub>x</sub> (k) | 06W (k)  |
| HORIZONTAL PROJ     | ECTION     |                | 30.0               | PARALL          | EL TO WL-A                | 135                 | 0.98           | 32.1           | 35.5                 | 30.6       | 1.3           | 4.8                | 2.9      |
|                     |            |                |                    | PARALI          | EL TO WL-1                | 238                 | 0.98           | 32.1           | 31.3                 | 19.6       | 1.4           | 7.5                | 4.5      |
| UPPER               |            |                | h (ft)             | Direction       |                           | Wall Area           |                | q <sub>h</sub> | Wall (PSF)           |            |               | F <sub>x</sub> (k) | 06W (k)  |
| HORIZONTAL PROJ     | ECTION     |                | 19.2               | PARALL          | EL TO WL-A                | 573                 | 0.90           | 29.5           | 34.4                 |            |               | 19.7               | 11.8     |
|                     |            |                |                    | PARALI          | EL TO WL-1                | 458                 | 0.90           | 29.5           | 30.6                 |            |               | 14.0               | 8.4      |
| MAIN                |            |                | h (ft)             | Direction       |                           | Wall Area           |                | q <sub>h</sub> | Wall (PSF)           |            |               | F <sub>x</sub> (k) | 06W (k)  |
| HORIZONTAL PROJ     | ECTION     |                | 9.2                | PARALL          | EL TO WL-A                | 688                 | 0.85           | 27.8           | 33.7                 |            |               | 23.2               | 13.9     |
|                     |            |                |                    | PARALI          | EL TO WL-1                | 278                 | 0.85           | 27.8           | 30.1                 |            |               | 8.4                | 5.0      |
| Base Shear - Parall | el to Wal  | ll Line A      |                    |                 |                           |                     |                |                |                      |            |               | 47.7               |          |
| Base Shear - Parall | el to Wal  | ll Line 1      |                    |                 |                           |                     |                |                |                      |            |               | 29.8               |          |







1. Shear wall demands have been increased where seismic controls design and h/L is greater than 2:1 per SDPWS Table 4.3.4. Where wind controls design, shearwall demands have been decreased 40% per IBC 2306.3.

| WALL LINE A      |         |                |      |          |            |            |      |              |             |             |                       |           |
|------------------|---------|----------------|------|----------|------------|------------|------|--------------|-------------|-------------|-----------------------|-----------|
| UPPER            |         | WIND TRIB =    | 11%  |          | ΣL =       | 14.25      |      |              |             |             |                       |           |
|                  |         | 0.6W (k) =     | 1.30 |          |            |            |      |              |             |             |                       |           |
|                  |         | SEISMIC TRIB = | 11%  |          |            |            |      |              |             |             |                       |           |
|                  |         | 0.7E (k) =     | 0.82 |          |            |            |      |              |             |             | Wall weight           |           |
| Segment<br>Count | HT (ft) | LENGTH (ft)    | h/L  | 2/(h/L)1 | 0.6W (plf) | 0.7E (plf) | SW   | SW Cap (plf) | Tension (k) | 0.6-0.14Sds | [0.6-0.14Sds]D<br>(k) | Net T (k) |
| 1                | 9.4     | 14.3           | 0.66 | 1.00     | 65         | 57         | SW 1 | 240          | 0.6         | 0.47        | 0.6                   | 0.3       |
| Concrete         |         |                |      |          |            |            |      |              |             |             |                       |           |

|   | <br> |  |
|---|------|--|
| _ |      |  |
|   |      |  |
|   |      |  |

| WALL LINE B      |         |                |      |            |            |            |      |              |             |             |                       |           | _          |        |        |      |       |
|------------------|---------|----------------|------|------------|------------|------------|------|--------------|-------------|-------------|-----------------------|-----------|------------|--------|--------|------|-------|
| ROOF             |         | WIND TRIB =    | 50%  | OPEN FRONT | ΣL =       | 30.75      |      |              |             |             |                       |           | OPEN FRONT |        | Mmax   | v    | v     |
|                  |         | 0.6W (k) =     | 1.45 | 1.75       |            |            |      |              |             |             |                       |           |            | W (ft) | (k-ft) | (k)  | (plf) |
|                  |         | SEISMIC TRIB = | 50%  |            |            |            |      |              |             |             |                       |           | 0.6W (k) = | 24.5   | 42.95  | 1.75 | 0.057 |
|                  |         | 0.7E (k) =     | 2.77 | 2.16       |            |            |      |              |             |             | Wall weight           |           | 0.7E (k) = | 24.5   | 52.94  | 2.16 | 0.070 |
| Segment<br>Count | HT (ft) | LENGTH (ft)    | h/L  | 2/(h/L)1   | 0.6W (plf) | 0.7E (plf) | SW   | SW Cap (plf) | Tension (k) | 0.6-0.14Sds | [0.6-0.14Sds]D<br>(k) | Net T (k) | I          |        |        |      |       |
| 1                | 10.2    | 3.8            | 2.72 | 0.73       | 41         | 123        | SW 1 | 240          | 0.9         | 0.47        | 0.2                   | 0.8       | I          |        |        |      |       |
| 1                | 10.2    | 15.0           | 0.68 | 1.00       | 41         | 90         | SW 1 | 240          | 0.9         | 0.47        | 0.7                   | 0.6       |            |        |        |      |       |
| 1                | 10.2    | 12.0           | 0.85 | 1.00       | 41         | 90         | SW 1 | 240          | 0.9         | 0.47        | 0.6                   | 0.6       |            |        |        |      |       |
| UPPER            |         | WIND TRIB =    | 33%  |            | ΣL =       | 18.00      |      |              |             |             |                       |           |            |        |        |      |       |
|                  |         | 0.6W (k) =     | 5.65 |            |            |            |      |              |             |             |                       |           |            |        |        |      |       |
|                  |         | SEISMIC TRIB = | 33%  |            |            |            |      |              |             |             |                       |           |            |        |        |      |       |
|                  |         | 0.7E (k) =     | 5.22 |            |            |            |      |              |             |             | Wall weight           |           | ļ          |        |        |      |       |
| Segment<br>Count | HT (ft) | LENGTH (ft)    | h/L  | 2/(h/L)1   | 0.6W (plf) | 0.7E (plf) | SW   | SW Cap (plf) | Tension (k) | 0.6-0.14Sds | [0.6-0.14Sds]D<br>(k) | Net T (k) |            |        |        |      |       |
| 1                | 9.4     | 5.5            | 1.70 | 1.00       | 224        | 290        | SW 2 | 355          | 2.7         | 0.47        | 0.2                   | 2.6       | Ĩ          |        |        |      |       |
| 1                | 9.4     | 12.5           | 0.75 | 1.00       | 224        | 290        | SW 2 | 355          | 2.7         | 0.47        | 0.5                   | 2.4       |            |        |        |      |       |

v (plf) 0.125 0.154

Concrete

| WALL LINE B.5 |         |                |      |                      |             |             |      |               |               |              |                |           |
|---------------|---------|----------------|------|----------------------|-------------|-------------|------|---------------|---------------|--------------|----------------|-----------|
| MAIN          |         | WIND TRIB =    | 21%  |                      |             |             |      |               |               |              |                |           |
|               |         | 0.6W (k) =     | 2.92 |                      |             |             |      |               |               |              |                |           |
|               |         | SEISMIC TRIB = | 23%  |                      |             |             |      |               |               |              |                |           |
|               |         | 0.7E (k) =     | 0.97 |                      |             |             |      |               |               |              | Wall weight    |           |
| Segment       | HT (ft) | LENGTH (ft)    | h/I  | 2/(b/L) <sup>1</sup> | 0.6W (nlf)  | 0 7E (nlf)  | sw   | SW Can (nlf)  | Tension (k)   | 0 6-0 145ds  | [0.6-0.14Sds]D | Net T (k) |
| Count         | ()      | EERO III (II)  | 11/2 | 2/(11/12)            | 0.011 (pii) | 0.7 E (pii) | 5    | Str cap (pii) | rension (iii) | 0.0 0.1 1505 | (k)            | Het I (k) |
| 1             | 9.4     | 15.0           | 0.63 | 1.00                 | 72          | 33          | SW 1 | 240           | 0.7           | 0.47         | 0.7            | 0.3       |
| 1             | 9.4     | 14.0           | 0.67 | 1.00                 | 72          | 33          | SW 1 | 240           | 0.7           | 0.47         | 0.6            | 0.4       |
|               |         |                |      |                      |             |             |      |               |               |              |                |           |

Concrete

| ROOF             |         | WIND TRIB =    | 50%  | OPEN FRONT           | ΣL =         | 14.00      |      |              |             |             |                       |           | OPEN FRONT |        | Mmax   | v    |
|------------------|---------|----------------|------|----------------------|--------------|------------|------|--------------|-------------|-------------|-----------------------|-----------|------------|--------|--------|------|
|                  |         | 0.6W (k) =     | 1.45 | 1.75                 |              |            |      |              |             |             |                       |           |            | W (ft) | (k-ft) | (k)  |
|                  |         | SEISMIC TRIB = | 50%  |                      |              |            |      |              |             |             |                       |           | 0.6W (k) = | 24.5   | 42.95  | 1.75 |
|                  |         | 0.7E (k) =     | 2.77 | 2.16                 |              |            |      |              |             |             | Wall weight           |           | 0.7E (k) = | 24.5   | 52.94  | 2.16 |
| Segment          | HT (ft) | LENGTH (ft)    | h/I  | 2/(h/L) <sup>1</sup> | 0.6W (plf)   | 0.7F (plf) | SW   | SW Cap (plf) | Tension (k) | 0.6-0.145ds | [0.6-0.14Sds]D        | Net T (k) | · · · /    |        |        |      |
| Count            |         | ()             |      | 2/(/2/               | 51611 (p.i.) | == (µ)     |      | e eek (k)    |             |             | (k)                   |           | ļ          |        |        |      |
| 1                | 10.2    | 4.0            | 2.55 | 0.78                 | 89           | 252        | SW 2 | 355          | 2.0         | 0.47        | 0.2                   | 1.9       |            |        |        |      |
| 1                | 10.2    | 10.0           | 1.02 | 1.00                 | 89           | 198        | SW 2 | 355          | 2.0         | 0.47        | 0.5                   | 1.8       |            |        |        |      |
| UPPER            |         | WIND TRIB =    | 39%  |                      | ΣL =         | 14.40      |      |              |             |             |                       |           |            |        |        |      |
|                  |         | 0.6W (k) =     | 6.06 |                      |              |            |      |              |             |             |                       |           |            |        |        |      |
|                  |         | SEISMIC TRIB = | 39%  |                      |              |            |      |              |             |             |                       |           |            |        |        |      |
|                  |         | 0.7E (k) =     | 5.66 |                      |              |            |      |              |             |             | Wall weight           |           |            |        |        |      |
| Segment<br>Count | HT (ft) | LENGTH (ft)    | h/L  | 2/(h/L)1             | 0.6W (plf)   | 0.7E (plf) | SW   | SW Cap (plf) | Tension (k) | 0.6-0.14Sds | [0.6-0.14Sds]D<br>(k) | Net T (k) | Ī          |        |        |      |
| 1                | 9.4     | 5.9            | 1.59 | 1.00                 | 300          | 393        | SW 3 | 455          | 3.7         | 0.47        | 0.3                   | 3.6       | t          |        |        |      |
| 2                | 9.4     | 4.3            | 2.21 | 0.91                 | 300          | 434        | SW 3 | 455          | 3.7         | 0.47        | 0.2                   | 3.6       |            |        |        |      |
| MAIN             |         | WIND TRIB =    | 23%  |                      | ΣL =         | 21.60      |      |              |             |             |                       |           |            |        |        |      |
|                  |         | 0.6W (k) =     | 9.25 |                      |              |            |      |              |             |             |                       |           |            |        |        |      |
|                  |         | SEISMIC TRIB = | 26%  |                      |              |            |      |              |             |             |                       |           |            |        |        |      |
|                  |         | 0.7E (k) =     | 6.76 |                      |              |            |      |              |             |             | Wall weight           |           |            |        |        |      |
| Segment<br>Count | HT (ft) | LENGTH (ft)    | h/L  | 2/(h/L)1             | 0.6W (plf)   | 0.7E (plf) | SW   | SW Cap (plf) | Tension (k) | 0.6-0.14Sds | [0.6-0.14Sds]D<br>(k) | Net T (k) | Ī          |        |        |      |
| 1                | 9.4     | 12.0           | 0.78 | 1.00                 | 306          | 313        | SW 4 | 595          | 2.9         | 0.47        | 0.5                   | 2.7       | 1          |        |        |      |
| 1                | 9.4     | 4.0            | 2.34 | 0.85                 | 306          | 367        | SW 4 | 595          | 2.9         | 0.47        | 0.2                   | 2.8       |            |        |        |      |
| 1                | 9.4     | 5.6            | 1.67 | 1.00                 | 306          | 313        | SW 4 | 595          | 2.9         | 0.47        | 0.2                   | 2.8       |            |        |        |      |
|                  |         |                |      |                      |              |            |      |              |             |             |                       |           |            |        |        |      |

| UPPER            |         | WIND TRIB =    | 17%  |          | ΣL =       | 20.00      |      |              |             |             |                       |           |
|------------------|---------|----------------|------|----------|------------|------------|------|--------------|-------------|-------------|-----------------------|-----------|
|                  |         | 0.6W (k) =     | 2.01 |          |            |            |      |              |             |             |                       |           |
|                  |         | SEISMIC TRIB = | 17%  |          |            |            |      |              |             |             |                       |           |
|                  |         | 0.7E (k) =     | 1.26 |          |            |            |      |              |             |             | Wall weight           |           |
| Segment<br>Count | HT (ft) | LENGTH (ft)    | h/L  | 2/(h/L)1 | 0.6W (plf) | 0.7E (plf) | SW   | SW Cap (plf) | Tension (k) | 0.6-0.14Sds | [0.6-0.14Sds]D<br>(k) | Net T (k) |
| 1                | 9.4     | 20.0           | 0.47 | 1.00     | 72         | 63         | SW 1 | 240          | 0.7         | 0.47        | 0.9                   | 0.2       |
| MAIN             |         | WIND TRIB =    | 43%  |          | ΣL =       | 12.00      |      |              |             |             |                       |           |
|                  |         | 0.6W (k) =     | 7.98 |          |            |            |      |              |             |             |                       |           |
|                  |         | SEISMIC TRIB = | 35%  |          |            |            |      |              |             |             |                       |           |
|                  |         | 0.7E (k) =     | 2.73 |          |            |            |      |              |             |             | Wall weight           |           |
| Segment<br>Count | HT (ft) | LENGTH (ft)    | h/L  | 2/(h/L)1 | 0.6W (plf) | 0.7E (plf) | SW   | SW Cap (plf) | Tension (k) | 0.6-0.14Sds | [0.6-0.14Sds]D<br>(k) | Net T (k) |
| 1                | 9.4     | 12.0           | 0.78 | 1.00     | 475        | 228        | SW 4 | 595          | 4.5         | 0.47        | 0.5                   | 4.2       |

1. Shear wall demands have been increased where seismic controls design and h/L is greater than 2:1 per SDPWS Table 4.3.4. Where wind controls design, shearwall demands have been decreased 40% per IBC 2306.3.

| WALL LINE 1      |         |                |      |                      |            |            |      |                 |             |             |                       |           |
|------------------|---------|----------------|------|----------------------|------------|------------|------|-----------------|-------------|-------------|-----------------------|-----------|
| ROOF             |         | WIND TRIB =    | 22%  |                      | ΣL =       | 11.30      |      |                 |             |             |                       |           |
|                  |         | 0.6W (k) =     | 0.99 |                      |            |            |      |                 |             |             |                       |           |
|                  |         | SEISMIC TRIB = | 22%  |                      |            |            |      |                 |             |             |                       |           |
|                  |         | 0.7E (k) =     | 1.22 |                      |            |            |      |                 |             |             | Wall weight           |           |
| Segment<br>Count | HT (ft) | LENGTH (ft)    | h/L  | 2/(h/L) <sup>1</sup> | 0.6W (plf) | 0.7E (plf) | SW   | SW Cap<br>(plf) | Tension (k) | 0.6-0.14Sds | [0.6-0.14Sds]D<br>(k) | Net T (k) |
| 1                | 10.2    | 11.3           | 0.90 | 1.00                 | 63         | 108        | SW 1 | 240             | 1.1         | 0.47        | 0.5                   | 0.8       |

Concrete

| WALL LINE 4      |          |                |      |                      |              |            |      |                 |             |             |                       |           |            |          |        |
|------------------|----------|----------------|------|----------------------|--------------|------------|------|-----------------|-------------|-------------|-----------------------|-----------|------------|----------|--------|
| ROOF             |          | WIND TRIB =    | 78%  |                      | ΣL =         | 11.80      |      |                 |             |             |                       |           | OPEN FRONT |          | Mmax   |
|                  |          | 0.6W (k) =     | 3.51 |                      |              |            |      |                 |             |             |                       |           |            | D/2 (ft) | (k-ft) |
|                  |          | SEISMIC TRIB = | 78%  |                      |              |            |      |                 |             |             |                       |           | 0.6W (k) = | 12.25    | 42.95  |
|                  |          | 0.7E (k) =     | 4.32 |                      |              |            |      |                 |             |             | Wall weight           |           | 0.7E (k) = | 12.25    | 52.94  |
| Segment          | ЦТ (f+)  | LENGTH (ft)    | h/I  | 2//b/U) <sup>1</sup> | 0.6\// (plf) | 0.75 (plf) | \$\M | SW Cap          | Tonsion (k) | 0.6.0.145dc | [0.6-0.14Sds]D        | Not T (k) |            |          |        |
| Count            | 111 (11) | LENGTH (IL)    | Π/L  | 2/(II/L)             | 0.000 (pii)  | 0.7E (pii) | 300  | (plf)           | Tension (k) | 0.0-0.14303 | (k)                   | Net I (K) |            |          |        |
| 1                | 10.2     | 7.0            | 1.46 | 1.00                 | 212          | 366        | SW 3 | 455             | 3.7         | 0.47        | 0.3                   | 3.6       |            |          |        |
| 1                | 10.2     | 4.8            | 2.13 | 0.94                 | 212          | 389        | SW 3 | 455             | 3.7         | 0.47        | 0.2                   | 3.6       |            |          |        |
| UPPER            |          | WIND TRIB =    | 50%  |                      | ΣL =         | 36.50      |      |                 |             |             |                       |           |            |          |        |
|                  |          | 0.6W (k) =     | 7.71 |                      |              |            |      |                 |             |             |                       |           |            |          |        |
|                  |          | SEISMIC TRIB = | 50%  |                      |              |            |      |                 |             |             |                       |           |            |          |        |
|                  |          | 0.7E (k) =     | 8.03 |                      |              |            |      |                 |             |             | Wall weight           |           |            |          |        |
| Segment<br>Count | HT (ft)  | LENGTH (ft)    | h/L  | 2/(h/L)1             | 0.6W (plf)   | 0.7E (plf) | SW   | SW Cap<br>(plf) | Tension (k) | 0.6-0.14Sds | [0.6-0.14Sds]D<br>(k) | Net T (k) |            |          |        |
| 1                | 9.4      | 24.5           | 0.38 | 1.00                 | 151          | 220        | SW 1 | 240             | 2.1         | 0.47        | 1.1                   | 1.5       |            |          |        |
| 1                | 9.4      | 12.0           | 0.78 | 1.00                 | 151          | 220        | SW 1 | 240             | 2.1         | 0.47        | 0.5                   | 1.8       |            |          |        |
|                  |          |                |      |                      |              |            |      |                 |             |             |                       |           | 1          |          |        |

## Concrete

| UPPER            |         | WIND TRIB =    | 50%  |          | ΣL =       | 12.70      |      |                 |             |             |                       |           |
|------------------|---------|----------------|------|----------|------------|------------|------|-----------------|-------------|-------------|-----------------------|-----------|
|                  |         | 0.6W (k) =     | 4.20 |          |            |            |      |                 |             |             |                       |           |
|                  |         | SEISMIC TRIB = | 50%  |          |            |            |      |                 |             |             |                       |           |
|                  |         | 0.7E (k) =     | 3.71 |          |            |            |      |                 |             |             | Wall weight           |           |
| Segment<br>Count | HT (ft) | LENGTH (ft)    | h/L  | 2/(h/L)1 | 0.6W (plf) | 0.7E (plf) | SW   | SW Cap<br>(plf) | Tension (k) | 0.6-0.14Sds | [0.6-0.14Sds]D<br>(k) | Net T (k) |
| 1                | 9.4     | 6.0            | 1.56 | 1.00     | 236        | 292        | SW 3 | 455             | 2.7         | 0.47        | 0.3                   | 2.6       |
| 1                | 9.4     | 3.8            | 2.47 | 0.81     | 236        | 360        | SW 3 | 455             | 2.7         | 0.47        | 0.2                   | 2.7       |
| 1                | 9.4     | 2.9            | 3.23 | 0.62     | 236        | 472        | SW 3 | 455             | 2.7         | 0.47        | 0.1                   | 2.7       |
| MAIN             |         | WIND TRIB =    | 50%  |          | ΣL =       | 21.00      |      |                 |             |             |                       |           |
|                  |         | 0.6W (k) =     | 6.71 |          |            |            |      |                 |             |             |                       |           |
|                  |         | SEISMIC TRIB = | 47%  |          |            |            |      |                 |             |             |                       |           |
|                  |         | 0.7E (k) =     | 5.69 |          |            |            |      |                 |             |             | Wall weight           |           |
| Segment<br>Count | HT (ft) | LENGTH (ft)    | h/L  | 2/(h/L)1 | 0.6W (plf) | 0.7E (plf) | SW   | SW Cap<br>(plf) | Tension (k) | 0.6-0.14Sds | [0.6-0.14Sds]D<br>(k) | Net T (k) |
| 1                | 8.5     | 21.0           | 0.41 | 1.00     | 228        | 271        | SW 3 | 455             | 2.3         | 0.47        | 0.8                   | 1.9       |

## Concrete

| WALL LINE 6      |         |                |      |          |            |            |      |                 |             |             |                       |           |
|------------------|---------|----------------|------|----------|------------|------------|------|-----------------|-------------|-------------|-----------------------|-----------|
| MAIN             |         | WIND TRIB =    | 18%  |          | ΣL =       | 3.80       |      |                 |             |             |                       |           |
|                  |         | 0.6W (k) =     | 0.90 |          |            |            |      |                 |             |             |                       |           |
|                  |         | SEISMIC TRIB = | 6%   |          |            |            |      |                 |             |             |                       |           |
|                  |         | 0.7E (k) =     | 0.25 |          |            |            |      |                 |             |             | Wall weight           |           |
| Segment<br>Count | HT (ft) | LENGTH (ft)    | h/L  | 2/(h/L)1 | 0.6W (plf) | 0.7E (plf) | SW   | SW Cap<br>(plf) | Tension (k) | 0.6-0.14Sds | [0.6-0.14Sds]D<br>(k) | Net T (k) |
| 1                | 8.5     | 3.8            | 2.25 | 0.89     | 170        | 75         | SW 1 | 240             | 1.4         | 0.47        | 0.2                   | 1.4       |
| Concrete         |         |                |      |          |            |            |      |                 |             |             |                       |           |