



October 13, 2023

**STRUCTURAL CALCULATIONS**  
(Permit Supplement)

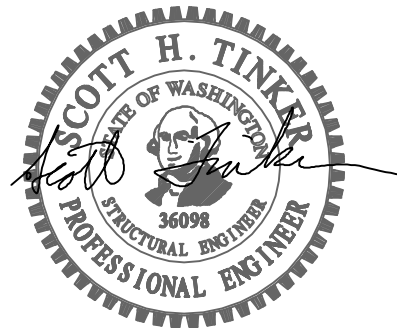
**HONG AND KAO RESIDENCE**

5425 W. Mercer Way  
Mercer Island, WA 98040

Quantum Job Number: 23127.01

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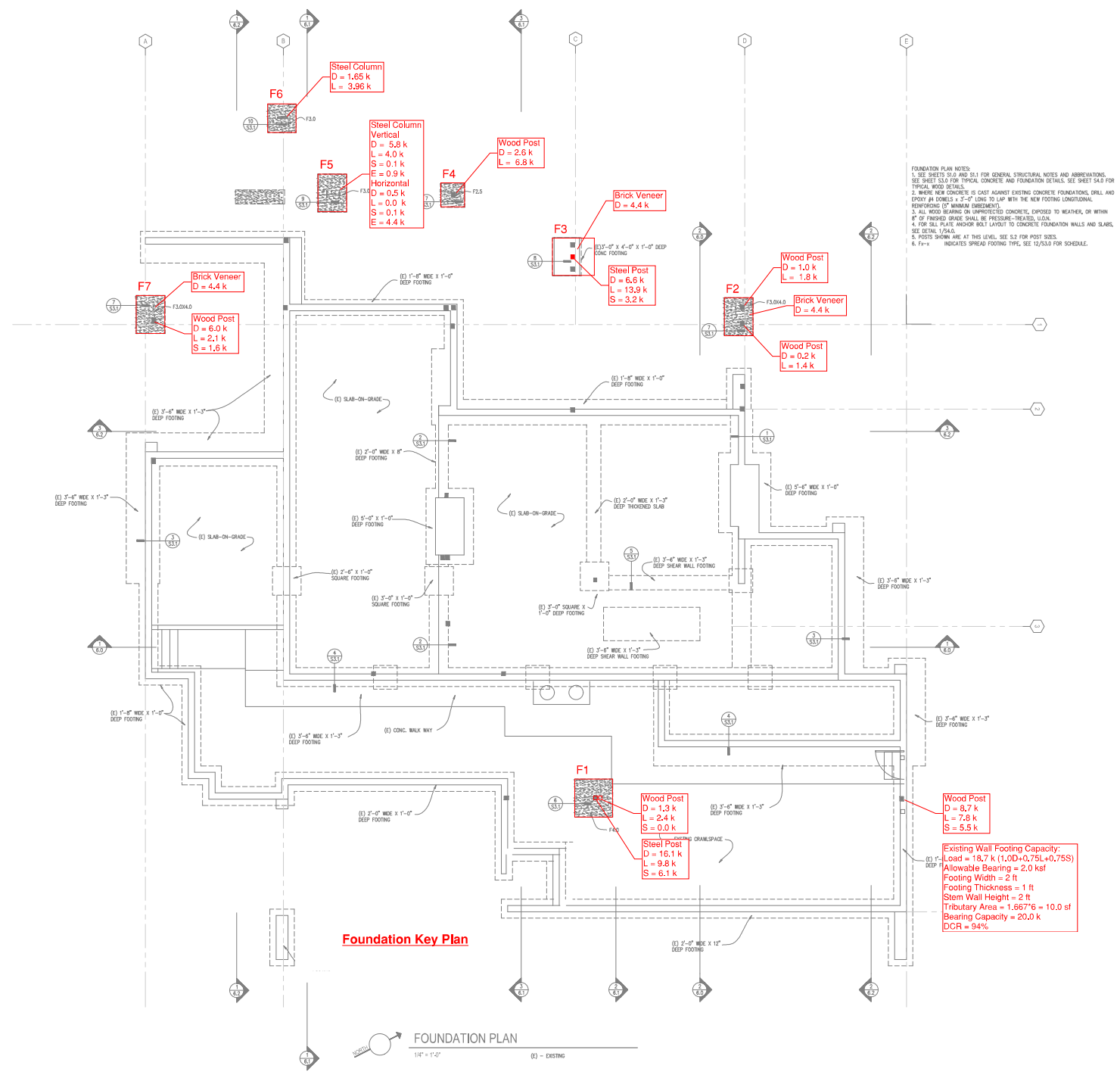


**HONG AND KAO RESIDENCE**

5425 W. Mercer Way  
Mercer Island, WA 98040

Quantum Job Number: 23127.01

# **FOUNDATION DESIGN – MAIN HOUSE**



9/28/23  
No. Date Revision

## General Footing

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

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### DESCRIPTION: Rev 1 - Foundation F1 - Spread Footing at BP4

#### Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : ASCE 7-16

#### General Information

##### Material Properties

|                                |   |             |
|--------------------------------|---|-------------|
| f'c : Concrete 28 day strength | = | 2.50 ksi    |
| fy : Rebar Yield               | = | 40.0 ksi    |
| Ec : Concrete Elastic Modulus  | = | 3,122.0 ksi |
| Concrete Density               | = | 145.0 pcf   |
| φ Values Flexure               | = | 0.90        |
| Shear                          | = | 0.750       |

##### Soil Design Values

|                                       |   |           |
|---------------------------------------|---|-----------|
| Allowable Soil Bearing                | = | 2.0 ksf   |
| Soil Density                          | = | 110.0 pcf |
| Increase Bearing By Footing Weight    | = | Yes       |
| Soil Passive Resistance (for Sliding) | = | 350.0 pcf |
| Soil/Concrete Friction Coeff.         | = | 0.350     |

##### Analysis Settings

|  |   |         |
|--|---|---------|
| Min Steel % Bending Reinf.                 | = |         |
| Min Allow % Temp Reinf.                    | = | 0.00180 |
| Min. Overturning Safety Factor             | = | 1.0 : 1 |
| Min. Sliding Safety Factor                 | = | 1.0 : 1 |
| Add Ftg Wt for Soil Pressure               | : | Yes     |
| Use ftg wt for stability, moments & shears | : | Yes     |
| Add Pedestal Wt for Soil Pressure          | : | No      |
| Use Pedestal wt for stability, mom & shear | : | No      |

##### Increases based on footing Depth

|  |   |         |
|--|---|---------|
| Footing base depth below soil surface                              | = | 1.50 ft |
| Allow press. increase per foot of depth when footing base is below | = | ksf ft  |

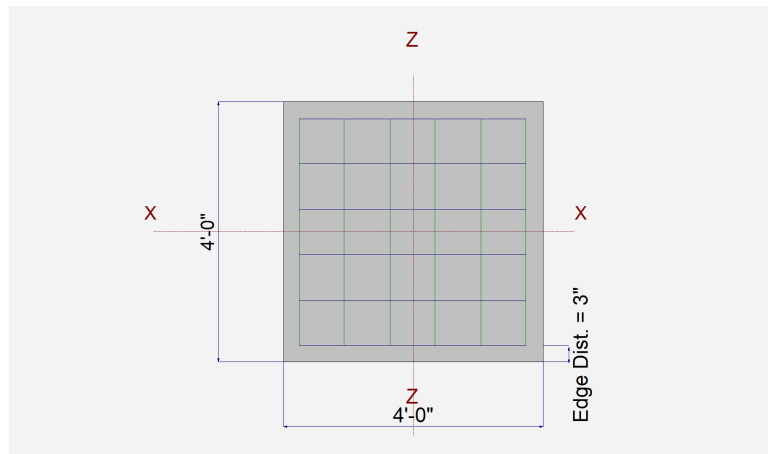
##### Increases based on footing plan dimension

|   |   |        |
|---|---|--------|
| Allowable pressure increase per foot of depth when max. length or width is greater than | = | ksf ft |
|---|---|--------|

#### Dimensions

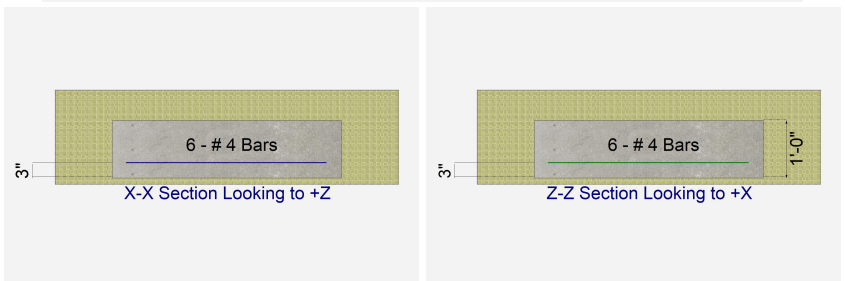
|                             |   |         |
|-----------------------------|---|---------|
| Width parallel to X-X Axis  | = | 4.0 ft  |
| Length parallel to Z-Z Axis | = | 4.0 ft  |
| Footing Thickness           | = | 12.0 in |

|  |   |        |
|--|---|--------|
| Pedestal dimensions...                                       |   |        |
| px : parallel to X-X Axis                                    | = | in     |
| pz : parallel to Z-Z Axis                                    | = | in     |
| Height   | = | in     |
| Rebar Centerline to Edge of Concrete... at Bottom of footing | = | 3.0 in |



#### Reinforcing

|  |   |     |
|--|---|-----|
| Bars parallel to X-X Axis                          |   |     |
| Number of Bars                                     | = | 6.0 |
| Reinforcing Bar Size                               | = | # 4 |
| Bars parallel to Z-Z Axis                          |   |     |
| Number of Bars                                     | = | 6.0 |
| Reinforcing Bar Size                               | = | # 4 |
| <b>Bandwidth Distribution Check (ACI 15.4.4.2)</b> |   |     |
| Direction Requiring Closer Separation              |   | n/a |
| # Bars required within zone                        |   | n/a |
| # Bars required on each side of zone               |   | n/a |



#### Applied Loads

|                 | D | Lr    | L | S     | W    | E | H    |
|-----------------|---|-------|---|-------|------|---|------|
| P : Column Load | = | 17.30 |   | 12.10 | 6.10 |   | k    |
| OB : Overburden | = |       |   |       |      |   | ksf  |
| M-xx            | = |       |   |       |      |   | k-ft |
| M-zz            | = |       |   |       |      |   | k-ft |
| V-x             | = |       |   |       |      |   | k    |
| V-z             | = |       |   |       |      |   | k    |

**General Footing**

**DESCRIPTION: Rev 1 - Foundation F1 - Spread Footing at BP4**

**DESIGN SUMMARY**

**Design OK**

|      | Min. Ratio | Item             | Applied       | Capacity      | Governing Load Combination      |
|------|------------|------------------|---------------|---------------|---------------------------------|
| PASS | 0.9949     | Soil Bearing     | 2.134 ksf     | 2.145 ksf     | +D+0.750L+0.750S about Z-Z axis |
| PASS | n/a        | Overturing - X-X | 0.0 k-ft      | 0.0 k-ft      | No Overturing                   |
| PASS | n/a        | Overturing - Z-Z | 0.0 k-ft      | 0.0 k-ft      | No Overturing                   |
| PASS | n/a        | Sliding - X-X    | 0.0 k         | 0.0 k         | No Sliding                      |
| PASS | n/a        | Sliding - Z-Z    | 0.0 k         | 0.0 k         | No Sliding                      |
| PASS | n/a        | Uplift           | 0.0 k         | 0.0 k         | No Uplift                       |
| PASS | 0.6841     | Z Flexure (+X)   | 5.396 k-ft/ft | 7.888 k-ft/ft | +1.20D+1.60L+0.50S              |
| PASS | 0.6841     | Z Flexure (-X)   | 5.396 k-ft/ft | 7.888 k-ft/ft | +1.20D+1.60L+0.50S              |
| PASS | 0.6841     | X Flexure (+Z)   | 5.396 k-ft/ft | 7.888 k-ft/ft | +1.20D+1.60L+0.50S              |
| PASS | 0.6841     | X Flexure (-Z)   | 5.396 k-ft/ft | 7.888 k-ft/ft | +1.20D+1.60L+0.50S              |
| PASS | 0.4130     | 1-way Shear (+X) | 30.978 psi    | 75.0 psi      | +1.20D+1.60L+0.50S              |
| PASS | 0.4130     | 1-way Shear (-X) | 30.978 psi    | 75.0 psi      | +1.20D+1.60L+0.50S              |
| PASS | 0.4130     | 1-way Shear (+Z) | 30.978 psi    | 75.0 psi      | +1.20D+1.60L+0.50S              |
| PASS | 0.4130     | 1-way Shear (-Z) | 30.978 psi    | 75.0 psi      | +1.20D+1.60L+0.50S              |
| PASS | 0.8595     | 2-way Punching   | 128.924 psi   | 150.0 psi     | +1.20D+1.60L+0.50S              |

**Detailed Results**

**Soil Bearing**

| Rotation Axis & Load Combination... | Gross Allowable | Xecc      |     | Actual Soil Bearing Stress @ Location |         |          |           | Actual / Allow Ratio |
|-------------------------------------|-----------------|-----------|-----|---------------------------------------|---------|----------|-----------|----------------------|
|                                     |                 | Zecc (in) |     | Bottom, -Z                            | Top, +Z | Left, -X | Right, +X |                      |
| X-X, D Only                         | 2.145           | n/a       | 0.0 | 1.281                                 | 1.281   | n/a      | n/a       | 0.597                |
| X-X, +D+L                           | 2.145           | n/a       | 0.0 | 2.038                                 | 2.038   | n/a      | n/a       | 0.950                |
| X-X, +D+S                           | 2.145           | n/a       | 0.0 | 1.663                                 | 1.663   | n/a      | n/a       | 0.775                |
| X-X, +D+0.750L                      | 2.145           | n/a       | 0.0 | 1.848                                 | 1.848   | n/a      | n/a       | 0.862                |
| X-X, +D+0.750L+0.750S               | 2.145           | n/a       | 0.0 | 2.134                                 | 2.134   | n/a      | n/a       | 0.995                |
| X-X, +0.60D                         | 2.145           | n/a       | 0.0 | 0.7688                                | 0.7688  | n/a      | n/a       | 0.358                |
| Z-Z, D Only                         | 2.145           | 0.0       | n/a | n/a                                   | n/a     | 1.281    | 1.281     | 0.597                |
| Z-Z, +D+L                           | 2.145           | 0.0       | n/a | n/a                                   | n/a     | 2.038    | 2.038     | 0.950                |
| Z-Z, +D+S                           | 2.145           | 0.0       | n/a | n/a                                   | n/a     | 1.663    | 1.663     | 0.775                |
| Z-Z, +D+0.750L                      | 2.145           | 0.0       | n/a | n/a                                   | n/a     | 1.848    | 1.848     | 0.862                |
| Z-Z, +D+0.750L+0.750S               | 2.145           | 0.0       | n/a | n/a                                   | n/a     | 2.134    | 2.134     | 0.995                |
| Z-Z, +0.60D                         | 2.145           | 0.0       | n/a | n/a                                   | n/a     | 0.7688   | 0.7688    | 0.358                |

**Overturing Stability**

| Rotation Axis & Load Combination... | Overturing Moment | Resisting Moment | Stability Ratio | Status |
|-------------------------------------|-------------------|------------------|-----------------|--------|
| Footing Has NO Overturing           |                   |                  |                 |        |

All units k

**Sliding Stability**

| Force Application Axis Load Combination... | Sliding Force | Resisting Force | Stability Ratio | Status |
|--|---------------|-----------------|-----------------|--------|
| Footing Has NO Sliding                     |               |                 |                 |        |

**Footing Flexure**

| Flexure Axis & Load Combination | Mu k-ft | Side | Tension Surface | As Req'd in^2 | Gvrn. As in^2 | Actual As in^2 | Phi*Mn k-ft | Status |
|---------------------------------|---------|------|-----------------|---------------|---------------|----------------|-------------|--------|
| X-X, +1.40D                     | 3.028   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.40D                     | 3.028   | -Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+1.60L               | 5.015   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+1.60L               | 5.015   | -Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+1.60L+0.50S         | 5.396   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+1.60L+0.50S         | 5.396   | -Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+L                   | 4.108   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+L                   | 4.108   | -Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D                     | 2.595   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D                     | 2.595   | -Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+L+1.60S             | 5.328   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+L+1.60S             | 5.328   | -Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+1.60S               | 3.815   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**General Footing**

Project File: Hong Kao - Rev 1.ec6

LIC#: KW-06016450, Build:20.23.07.20

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**DESCRIPTION: Rev 1 - Foundation F1 - Spread Footing at BP4**

**Footing Flexure**

| Flexure Axis & Load Combination | Mu<br>k-ft | Side | Tension<br>Surface | As Req'd<br>in^2 | Gvrn. As<br>in^2 | Actual As<br>in^2 | Phi*Mn<br>k-ft | Status |
|---------------------------------|------------|------|--------------------|------------------|------------------|-------------------|----------------|--------|
| X-X, +1.20D+1.60S               | 3.815      | -Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| X-X, +1.20D+L+0.50S             | 4.489      | +Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| X-X, +1.20D+L+0.50S             | 4.489      | -Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| X-X, +0.90D                     | 1.946      | +Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| X-X, +0.90D                     | 1.946      | -Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| X-X, +1.20D+L+0.20S             | 4.260      | +Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| X-X, +1.20D+L+0.20S             | 4.260      | -Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.40D                     | 3.028      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.40D                     | 3.028      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L               | 5.015      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L               | 5.015      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L+0.50S         | 5.396      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L+0.50S         | 5.396      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L                   | 4.108      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L                   | 4.108      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D                     | 2.595      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D                     | 2.595      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+1.60S             | 5.328      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+1.60S             | 5.328      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60S               | 3.815      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60S               | 3.815      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.50S             | 4.489      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.50S             | 4.489      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +0.90D                     | 1.946      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +0.90D                     | 1.946      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.20S             | 4.260      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.20S             | 4.260      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |

**One Way Shear**

| Load Combination... | Vu @ -X   | Vu @ +X   | Vu @ -Z   | Vu @ +Z   | Vu:Max    | Phi Vn    | Vu / Phi*Vn | Status |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|--------|
| +1.40D              | 17.38 psi | 17.38 psi | 17.38 psi | 17.38 psi | 17.38 psi | 75.00 psi | 0.23        | OK     |
| +1.20D+1.60L        | 28.79 psi | 28.79 psi | 28.79 psi | 28.79 psi | 28.79 psi | 75.00 psi | 0.38        | OK     |
| +1.20D+1.60L+0.50S  | 30.98 psi | 30.98 psi | 30.98 psi | 30.98 psi | 30.98 psi | 75.00 psi | 0.41        | OK     |
| +1.20D+L            | 23.58 psi | 23.58 psi | 23.58 psi | 23.58 psi | 23.58 psi | 75.00 psi | 0.31        | OK     |
| +1.20D              | 14.90 psi | 14.90 psi | 14.90 psi | 14.90 psi | 14.90 psi | 75.00 psi | 0.20        | OK     |
| +1.20D+L+1.60S      | 30.58 psi | 30.58 psi | 30.58 psi | 30.58 psi | 30.58 psi | 75.00 psi | 0.41        | OK     |
| +1.20D+1.60S        | 21.90 psi | 21.90 psi | 21.90 psi | 21.90 psi | 21.90 psi | 75.00 psi | 0.29        | OK     |
| +1.20D+L+0.50S      | 25.77 psi | 25.77 psi | 25.77 psi | 25.77 psi | 25.77 psi | 75.00 psi | 0.34        | OK     |
| +0.90D              | 11.17 psi | 11.17 psi | 11.17 psi | 11.17 psi | 11.17 psi | 75.00 psi | 0.15        | OK     |
| +1.20D+L+0.20S      | 24.46 psi | 24.46 psi | 24.46 psi | 24.46 psi | 24.46 psi | 75.00 psi | 0.33        | OK     |

All units k

**Two-Way "Punching" Shear**

| Load Combination... | Vu         | Phi*Vn    | Vu / Phi*Vn | Status |
|---------------------|------------|-----------|-------------|--------|
| +1.40D              | 72.33 psi  | 150.00psi | 0.4822      | OK     |
| +1.20D+1.60L        | 119.82 psi | 150.00psi | 0.7988      | OK     |
| +1.20D+1.60L+0.50S  | 128.92 psi | 150.00psi | 0.8595      | OK     |
| +1.20D+L            | 98.13 psi  | 150.00psi | 0.6542      | OK     |
| +1.20D              | 62.00 psi  | 150.00psi | 0.4133      | OK     |
| +1.20D+L+1.60S      | 127.28 psi | 150.00psi | 0.8485      | OK     |
| +1.20D+1.60S        | 91.15 psi  | 150.00psi | 0.6076      | OK     |
| +1.20D+L+0.50S      | 107.24 psi | 150.00psi | 0.7149      | OK     |
| +0.90D              | 46.50 psi  | 150.00psi | 0.31        | OK     |
| +1.20D+L+0.20S      | 101.78 psi | 150.00psi | 0.6785      | OK     |

## Combined Footing

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

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### DESCRIPTION: Rev 1 - Foundation F2 - Deck Spread Footing

#### Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : ASCE 7-16

#### General Information

##### Material Properties

|                                |             |
|--------------------------------|-------------|
| f'c : Concrete 28 day strength | 2.50 ksi    |
| fy : Rebar Yield               | 40.0 ksi    |
| Ec : Concrete Elastic Modulus  | 3,122.0 kcf |
| Concrete Density               | 145.0 pcf   |
| φ : Phi Values                 |             |
| Flexure :                      | 0.90        |
| Shear :                        | 0.750       |

##### Analysis/Design Settings

|  |         |
|--|---------|
| Calculate footing weight as dead load ?  | Yes     |
| Calculate Pedestal weight as dead load ? | No      |
| Min Steel % Bending Reinf (based on 'd') |         |
| Min Allow % Temp Reinf (based on thick)  | 0.00180 |
| Min. Overturning Safety Factor           | 1.0: 1  |
| Min. Sliding Safety Factor               | 1.0: 1  |

#### Soil Information

|   |           |
|---|-----------|
| Allowable Soil Bearing  | 2.0 ksf   |
| Increase Bearing By Footing Weight  | Yes       |
| Soil Passive Sliding Resistance   | 350.0 pcf |
| <i>(Uses entry for "Footing base depth below soil surface" for force)</i> |           |
| Coefficient of Soil/Concrete Friction                                     | 0.350     |

##### Soil Bearing Increase

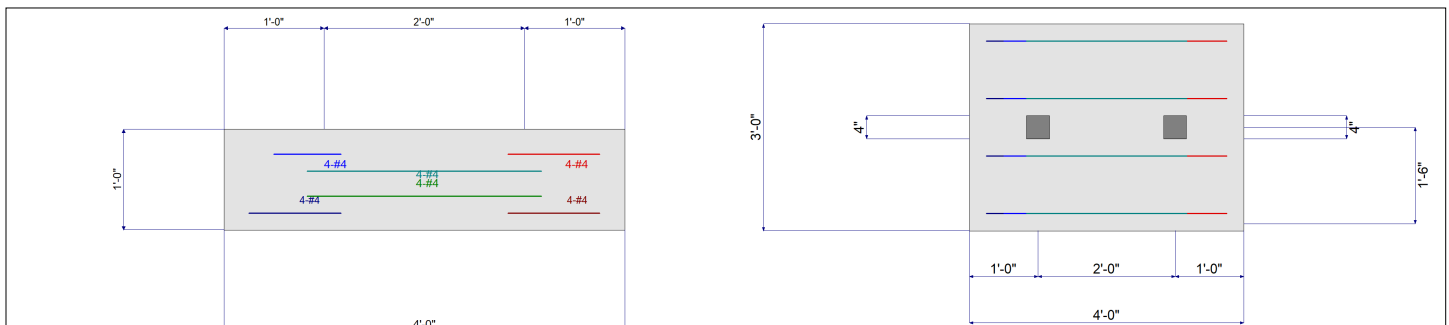
|   |           |
|---|-----------|
| Footing base depth below soil surface   | ft        |
| Increases based on footing Depth . . . .  |           |
| Allowable pressure increase per foot  | ksf       |
| when base of footing is below   | ft        |
| Increases based on footing Width . . .  |           |
| Allowable pressure increase per foot  | ksf       |
| when maximum length or width is greater than  | ft        |
| Maximum Allowed Bearing Pressure  | 10.0 ksf  |
| <i>(A value of zero implies no limit)</i>   |           |
| Adjusted Allowable Soil Bearing   | 2.145 ksf |
| <i>(Allowable Soil Bearing adjusted for footing weight and depth &amp; width increases as specified by user.)</i> |           |

#### Dimensions & Reinforcing

|   |                        |        |        |                      |       |        |             |                        |
|---|------------------------|--------|--------|----------------------|-------|--------|-------------|------------------------|
| Distance Left of Column #1 = 1.0 ft             | Pedestal dimensions... | Col #1 | Col #2 | Bars left of Col #1  | Count | Size # | As Provided | As Req'd               |
| Between Columns = 2.0 ft                        |                        |        |        |                      |       |        |             |                        |
| Distance Right of Column #2 = 1.0 ft            |                        |        |        | Top Bars             | 4.0   | 4      | 0.80        | 0.3888 in <sup>2</sup> |
| Total Footing Length = 4.0 ft                   | Height =               |        |        | Bars Btwn Cols       |       |        |             |                        |
| Footing Width = 3.0 ft                          |                        |        |        | Bottom Bars          | 4.0   | 4      | 0.80        | 0.3888 in <sup>2</sup> |
| Footing Thickness = 12.0 in                     |                        |        |        | Top Bars             | 4.0   | 4      | 0.80        | 0.3888 in <sup>2</sup> |
| Rebar Center to Concrete Edge @ Top = 3.0 in    |                        |        |        | Bars Right of Col #2 |       |        |             |                        |
| Rebar Center to Concrete Edge @ Bottom = 2.0 in |                        |        |        | Bottom Bars          | 4.0   | 4      | 0.80        | 0.3888 in <sup>2</sup> |
|   |                        |        |        | Top Bars             | 4.0   | 4      | 0.80        | 0.3888 in <sup>2</sup> |

#### Applied Loads

|                               |          |           |          |          |          |          |          |
|-------------------------------|----------|-----------|----------|----------|----------|----------|----------|
| <b>Applied @ Left Column</b>  | <b>D</b> | <b>Lr</b> | <b>L</b> | <b>S</b> | <b>W</b> | <b>E</b> | <b>H</b> |
| Axial Load Downward =         | 2.40     |           | 1.40     |          |          |          | k        |
| Moment (+CW) =                |          |           |          |          |          |          | k-ft     |
| Shear (+X) =                  |          |           |          |          |          |          | k        |
| <b>Applied @ Right Column</b> |          |           |          |          |          |          |          |
| Axial Load Downward =         | 3.20     |           | 1.80     |          |          |          | k        |
| Moment (+CW) =                |          |           |          |          |          |          | k-ft     |
| Shear (+X) =                  |          |           |          |          |          |          | k        |
| <b>Overburden</b> =           |          |           |          |          |          |          |          |





Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Combined Footing

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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### DESCRIPTION: Rev 1 - Foundation F2 - Deck Spread Footing

#### DESIGN SUMMARY

Design OK

| Factor of Safety | Item       | Applied     | Capacity | Governing Load Combination |            |
|------------------|------------|-------------|----------|----------------------------|------------|
| PASS             | No OTM     | Overturning | 0.0 k-ft | 0.0 k-ft                   | No OTM     |
| PASS             | No Sliding | Sliding     | 0.0 k    | 2.569 k                    | No Sliding |
| PASS             | No Uplift  | Uplift      | 0.0 k    | 0.0 k                      | No Uplift  |

| Utilization Ratio | Item       | Applied                            | Capacity    | Governing Load Combination |              |
|-------------------|------------|------------------------------------|-------------|----------------------------|--------------|
| PASS              | 0.4792     | Soil Bearing                       | 1.028 ksf   | 2.145 ksf                  | +D+L         |
| PASS              | 0.007407   | 1-way Shear - Col #1               | 0.5556 psi  | 75.0 psi                   | +1.20D+1.60L |
| PASS              | 0.007407   | 1-way Shear - Col #2               | 0.5556 psi  | 75.0 psi                   | +1.20D+1.60L |
| PASS              | 0.04682    | 2-way Punching - Col #1            | 7.023 psi   | 150.0 psi                  | +1.20D+1.60L |
| PASS              | 0.04363    | 2-way Punching - Col #2            | 6.544 psi   | 150.0 psi                  | +1.20D+1.60L |
| PASS              | No Bending | Flexure - Left of Col #1 - Top     | 0.0 k-ft    | 0.0 k-ft                   | N/A          |
| PASS              | 0.03581    | Flexure - Left of Col #1 - Bottom  | 0.8415 k-ft | 23.498 k-ft                | +1.20D+1.60L |
| PASS              | No Bending | Flexure - Between Cols - Top       | 0.0 k-ft    | 0.0 k-ft                   | N/A          |
| PASS              | 0.05167    | Flexure - Between Cols - Bottom    | 1.214 k-ft  | 23.498 k-ft                | +1.20D+1.60L |
| PASS              | No Bending | Flexure - Right of Col #2 - Top    | 0.0 k-ft    | 0.0 k-ft                   | N/A          |
| PASS              | 0.05097    | Flexure - Right of Col #2 - Bottom | 1.198 k-ft  | 23.498 k-ft                | +1.20D+1.60L |

#### Soil Bearing

| Load Combination... | Total Bearing | Eccentricity<br>from Ftg CL | Actual Soil Bearing Stress |              | Allowable | Actual / Allow<br>Ratio |
|---------------------|---------------|-----------------------------|----------------------------|--------------|-----------|-------------------------|
|                     |               |                             | @ Left Edge                | @ Right Edge |           |                         |
| D Only              | 7.34 k        | 0.109 ft                    | 0.51 ksf                   | 0.71 ksf     | 2.15 ksf  | 0.332                   |
| +D+L                | 10.54 k       | 0.114 ft                    | 0.73 ksf                   | 1.03 ksf     | 2.15 ksf  | 0.479                   |
| +D+0.750L           | 9.74 k        | 0.113 ft                    | 0.67 ksf                   | 0.95 ksf     | 2.15 ksf  | 0.442                   |
| +0.60D              | 4.40 k        | 0.109 ft                    | 0.31 ksf                   | 0.43 ksf     | 2.15 ksf  | 0.199                   |

#### Overturning Stability

| Load Combination... | Moments about Left Edge k-ft |           |         | Moments about Right Edge k-ft |           |         |
|---------------------|------------------------------|-----------|---------|-------------------------------|-----------|---------|
|                     | Overturning                  | Resisting | Ratio   | Overturning                   | Resisting | Ratio   |
| D Only              | 0.00                         | 0.00      | 999.000 | 0.00                          | 0.00      | 999.000 |
| +D+L                | 0.00                         | 0.00      | 999.000 | 0.00                          | 0.00      | 999.000 |
| +D+0.750L           | 0.00                         | 0.00      | 999.000 | 0.00                          | 0.00      | 999.000 |
| +0.60D              | 0.00                         | 0.00      | 999.000 | 0.00                          | 0.00      | 999.000 |

#### Sliding Stability

| Load Combination... | Sliding Force | Resisting Force | Sliding Safety Ratio |
|---------------------|---------------|-----------------|----------------------|
| D Only              | 0.00 k        | 2.57 k          | 999                  |
| +D+L                | 0.00 k        | 3.69 k          | 999                  |
| +D+0.750L           | 0.00 k        | 3.41 k          | 999                  |
| +0.60D              | 0.00 k        | 1.54 k          | 999                  |

#### Z-Axis Footing Flexure - Maximum Values for Load Combination

| Load Combination... | Mu<br>(ft-k) | Distance<br>from left<br>(ft) | Tension<br>Side | As Req'd<br>(in^2) | Governed<br>by | Actual As<br>(in^2) | Phi*Mn<br>(ft-k) | Mu / PhiMn |
|---------------------|--------------|-------------------------------|-----------------|--------------------|----------------|---------------------|------------------|------------|
| +0.60D              | 0.000        | 0.000                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +0.60D              | 0.000        | 0.010                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +0.60D              | 0.000        | 0.020                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +0.60D              | 0.000        | 0.030                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +0.60D              | 0.000        | 0.040                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +0.60D              | 0.000        | 0.050                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +0.60D              | 0.000        | 0.060                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +0.60D              | 0.000        | 0.070                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +0.60D              | 0.000        | 0.080                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +0.60D              | 0.000        | 0.090                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.012        | 0.100                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.014        | 0.110                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.017        | 0.120                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.020        | 0.130                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.023        | 0.140                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Combined Footing**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION: Rev 1 - Foundation F2 - Deck Spread Footing**

**Z-Axis Footing Flexure - Maximum Values for Load Combination**

| Load Combination... | Mu<br>(ft-k) | Distance<br>from left<br>(ft) | Tension<br>Side | As Req'd<br>(in^2) | Governed<br>by | Actual As<br>(in^2) | Phi*Mn<br>(ft-k) | Mu / PhiMn |
|---------------------|--------------|-------------------------------|-----------------|--------------------|----------------|---------------------|------------------|------------|
| +1.20D+1.60L        | 0.027        | 0.150                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.030        | 0.160                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.034        | 0.170                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.039        | 0.180                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.043        | 0.190                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.048        | 0.200                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.053        | 0.210                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.058        | 0.220                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.063        | 0.230                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.069        | 0.240                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.075        | 0.250                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.081        | 0.260                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.087        | 0.270                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.004      |
| +1.20D+1.60L        | 0.094        | 0.280                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.004      |
| +1.20D+1.60L        | 0.100        | 0.290                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.004      |
| +1.20D+1.60L        | 0.108        | 0.300                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.005      |
| +1.20D+1.60L        | 0.115        | 0.310                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.005      |
| +1.20D+1.60L        | 0.122        | 0.320                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.005      |
| +1.20D+1.60L        | 0.130        | 0.330                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.006      |
| +1.20D+1.60L        | 0.138        | 0.340                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.006      |
| +1.20D+1.60L        | 0.147        | 0.350                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.006      |
| +1.20D+1.60L        | 0.155        | 0.360                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.007      |
| +1.20D+1.60L        | 0.164        | 0.370                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.007      |
| +1.20D+1.60L        | 0.173        | 0.380                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.007      |
| +1.20D+1.60L        | 0.182        | 0.390                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.008      |
| +1.20D+1.60L        | 0.192        | 0.400                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.008      |
| +1.20D+1.60L        | 0.202        | 0.410                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.009      |
| +1.20D+1.60L        | 0.212        | 0.420                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.009      |
| +1.20D+1.60L        | 0.222        | 0.430                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.009      |
| +1.20D+1.60L        | 0.233        | 0.440                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.010      |
| +1.20D+1.60L        | 0.244        | 0.450                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.010      |
| +1.20D+1.60L        | 0.255        | 0.460                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.011      |
| +1.20D+1.60L        | 0.266        | 0.470                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.011      |
| +1.20D+1.60L        | 0.277        | 0.480                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.012      |
| +1.20D+1.60L        | 0.289        | 0.490                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.012      |
| +1.20D+1.60L        | 0.301        | 0.500                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.013      |
| +1.20D+1.60L        | 0.314        | 0.510                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.013      |
| +1.20D+1.60L        | 0.326        | 0.520                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.014      |
| +1.20D+1.60L        | 0.339        | 0.530                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.014      |
| +1.20D+1.60L        | 0.352        | 0.540                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.015      |
| +1.20D+1.60L        | 0.365        | 0.550                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.016      |
| +1.20D+1.60L        | 0.379        | 0.560                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.016      |
| +1.20D+1.60L        | 0.393        | 0.570                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.017      |
| +1.20D+1.60L        | 0.407        | 0.580                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.017      |
| +1.20D+1.60L        | 0.421        | 0.590                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.018      |
| +1.20D+1.60L        | 0.436        | 0.600                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.019      |
| +1.20D+1.60L        | 0.450        | 0.610                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.019      |
| +1.20D+1.60L        | 0.466        | 0.620                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.020      |
| +1.20D+1.60L        | 0.481        | 0.630                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.020      |
| +1.20D+1.60L        | 0.496        | 0.640                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.021      |
| +1.20D+1.60L        | 0.512        | 0.650                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.022      |
| +1.20D+1.60L        | 0.528        | 0.660                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.022      |
| +1.20D+1.60L        | 0.545        | 0.670                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.023      |
| +1.20D+1.60L        | 0.561        | 0.680                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.024      |
| +1.20D+1.60L        | 0.578        | 0.690                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.025      |
| +1.20D+1.60L        | 0.595        | 0.700                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.025      |
| +1.20D+1.60L        | 0.613        | 0.710                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.026      |
| +1.20D+1.60L        | 0.630        | 0.720                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.027      |
| +1.20D+1.60L        | 0.648        | 0.730                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.028      |
| +1.20D+1.60L        | 0.666        | 0.740                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.028      |
| +1.20D+1.60L        | 0.685        | 0.750                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.029      |
| +1.20D+1.60L        | 0.704        | 0.760                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.030      |
| +1.20D+1.60L        | 0.722        | 0.770                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.031      |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Combined Footing**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION: Rev 1 - Foundation F2 - Deck Spread Footing**

**Z-Axis Footing Flexure - Maximum Values for Load Combination**

| Load Combination... | Mu<br>(ft-k) | Distance<br>from left<br>(ft) | Tension<br>Side | As Req'd<br>(in^2) | Governed<br>by | Actual As<br>(in^2) | Phi*Mn<br>(ft-k) | Mu / PhiMn |
|---------------------|--------------|-------------------------------|-----------------|--------------------|----------------|---------------------|------------------|------------|
| +1.20D+1.60L        | 0.742        | 0.780                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.032      |
| +1.20D+1.60L        | 0.761        | 0.790                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.032      |
| +1.20D+1.60L        | 0.781        | 0.800                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.033      |
| +1.20D+1.60L        | 0.801        | 0.810                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.034      |
| +1.20D+1.60L        | 0.821        | 0.820                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.035      |
| +1.20D+1.60L        | 0.841        | 0.830                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.036      |
| +1.20D+1.60L        | 0.862        | 0.840                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.037      |
| +1.20D+1.60L        | 0.881        | 0.850                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.037      |
| +1.20D+1.60L        | 0.899        | 0.860                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.038      |
| +1.20D+1.60L        | 0.916        | 0.870                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.039      |
| +1.20D+1.60L        | 0.931        | 0.880                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.040      |
| +1.20D+1.60L        | 0.945        | 0.890                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.040      |
| +1.20D+1.60L        | 0.958        | 0.900                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.041      |
| +1.20D+1.60L        | 0.970        | 0.910                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.041      |
| +1.20D+1.60L        | 0.980        | 0.920                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.042      |
| +1.20D+1.60L        | 0.989        | 0.930                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.042      |
| +1.20D+1.60L        | 0.997        | 0.940                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.042      |
| +1.20D+1.60L        | 1.003        | 0.950                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.043      |
| +1.20D+1.60L        | 1.009        | 0.960                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.043      |
| +1.20D+1.60L        | 1.012        | 0.970                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.043      |
| +1.20D+1.60L        | 1.015        | 0.980                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.043      |
| +1.20D+1.60L        | 1.017        | 0.990                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.043      |
| +1.20D+1.60L        | 1.017        | 1.000                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.043      |
| +1.20D+1.60L        | 1.016        | 1.010                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.043      |
| +1.20D+1.60L        | 1.013        | 1.020                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.043      |
| +1.20D+1.60L        | 1.009        | 1.030                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.043      |
| +1.20D+1.60L        | 1.005        | 1.040                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.043      |
| +1.20D+1.60L        | 0.998        | 1.050                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.042      |
| +1.20D+1.60L        | 0.991        | 1.060                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.042      |
| +1.20D+1.60L        | 0.982        | 1.070                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.042      |
| +1.20D+1.60L        | 0.972        | 1.080                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.041      |
| +1.20D+1.60L        | 0.961        | 1.090                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.041      |
| +1.20D+1.60L        | 0.948        | 1.100                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.040      |
| +1.20D+1.60L        | 0.934        | 1.110                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.040      |
| +1.20D+1.60L        | 0.919        | 1.120                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.039      |
| +1.20D+1.60L        | 0.903        | 1.130                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.038      |
| +1.20D+1.60L        | 0.885        | 1.140                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.038      |
| +1.20D+1.60L        | 0.866        | 1.150                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.037      |
| +1.20D+1.60L        | 0.846        | 1.160                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.036      |
| +1.20D+1.60L        | 0.825        | 1.170                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.035      |
| +1.20D+1.60L        | 0.804        | 1.180                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.034      |
| +1.20D+1.60L        | 0.782        | 1.190                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.033      |
| +1.20D+1.60L        | 0.762        | 1.200                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.032      |
| +1.20D+1.60L        | 0.741        | 1.210                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.032      |
| +1.20D+1.60L        | 0.721        | 1.220                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.031      |
| +1.20D+1.60L        | 0.701        | 1.230                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.030      |
| +1.20D+1.60L        | 0.681        | 1.240                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.029      |
| +1.20D+1.60L        | 0.661        | 1.250                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.028      |
| +1.20D+1.60L        | 0.642        | 1.260                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.027      |
| +1.20D+1.60L        | 0.623        | 1.270                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.027      |
| +1.20D+1.60L        | 0.605        | 1.280                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.026      |
| +1.20D+1.60L        | 0.586        | 1.290                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.025      |
| +1.20D+1.60L        | 0.568        | 1.300                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.024      |
| +1.20D+1.60L        | 0.550        | 1.310                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.023      |
| +1.20D+1.60L        | 0.533        | 1.320                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.023      |
| +1.20D+1.60L        | 0.515        | 1.330                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.022      |
| +1.20D+1.60L        | 0.498        | 1.340                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.021      |
| +1.20D+1.60L        | 0.482        | 1.350                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.020      |
| +1.20D+1.60L        | 0.465        | 1.360                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.020      |
| +1.20D+1.60L        | 0.449        | 1.370                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.019      |
| +1.20D+1.60L        | 0.433        | 1.380                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.018      |
| +1.20D+1.60L        | 0.417        | 1.390                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.018      |
| +1.20D+1.60L        | 0.402        | 1.400                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.017      |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Combined Footing**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION: Rev 1 - Foundation F2 - Deck Spread Footing**

**Z-Axis Footing Flexure - Maximum Values for Load Combination**

| Load Combination... | Mu<br>(ft-k) | Distance<br>from left<br>(ft) | Tension<br>Side | As Req'd<br>(in^2) | Governed<br>by | Actual As<br>(in^2) | Phi*Mn<br>(ft-k) | Mu / PhiMn |
|---------------------|--------------|-------------------------------|-----------------|--------------------|----------------|---------------------|------------------|------------|
| +1.20D+1.60L        | 0.387        | 1.410                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.016      |
| +1.20D+1.60L        | 0.372        | 1.420                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.016      |
| +1.20D+1.60L        | 0.358        | 1.430                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.015      |
| +1.20D+1.60L        | 0.343        | 1.440                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.015      |
| +1.20D+1.60L        | 0.329        | 1.450                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.014      |
| +1.20D+1.60L        | 0.316        | 1.460                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.013      |
| +1.20D+1.60L        | 0.302        | 1.470                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.013      |
| +1.20D+1.60L        | 0.289        | 1.480                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.012      |
| +1.20D+1.60L        | 0.276        | 1.490                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.012      |
| +1.20D+1.60L        | 0.264        | 1.500                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.011      |
| +1.20D+1.60L        | 0.251        | 1.510                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.011      |
| +1.20D+1.60L        | 0.239        | 1.520                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.010      |
| +1.20D+1.60L        | 0.228        | 1.530                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.010      |
| +1.20D+1.60L        | 0.216        | 1.540                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.009      |
| +1.20D+1.60L        | 0.205        | 1.550                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.009      |
| +1.20D+1.60L        | 0.194        | 1.560                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.008      |
| +1.20D+1.60L        | 0.184        | 1.570                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.008      |
| +1.20D+1.60L        | 0.173        | 1.580                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.007      |
| +1.20D+1.60L        | 0.163        | 1.590                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.007      |
| +1.20D+1.60L        | 0.154        | 1.600                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.007      |
| +1.20D+1.60L        | 0.144        | 1.610                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.006      |
| +1.20D+1.60L        | 0.135        | 1.620                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.006      |
| +1.20D+1.60L        | 0.126        | 1.630                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.005      |
| +1.20D+1.60L        | 0.117        | 1.640                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.005      |
| +1.20D+1.60L        | 0.109        | 1.650                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.005      |
| +1.20D+1.60L        | 0.101        | 1.660                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.004      |
| +1.20D+1.60L        | 0.093        | 1.670                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.004      |
| +1.20D+1.60L        | 0.086        | 1.680                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.004      |
| +1.20D+1.60L        | 0.079        | 1.690                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.072        | 1.700                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.065        | 1.710                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.059        | 1.720                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.053        | 1.730                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.047        | 1.740                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.042        | 1.750                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.037        | 1.760                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.032        | 1.770                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.027        | 1.780                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.023        | 1.790                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.019        | 1.800                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.015        | 1.810                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.012        | 1.820                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.830                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.840                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.850                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.860                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.870                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.880                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.890                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.900                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.910                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.920                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.930                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.940                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.950                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.960                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.970                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.980                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 1.990                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 2.000                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 2.010                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 2.020                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 2.030                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Combined Footing**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION: Rev 1 - Foundation F2 - Deck Spread Footing**

**Z-Axis Footing Flexure - Maximum Values for Load Combination**

| Load Combination... | Mu<br>(ft-k) | Distance<br>from left<br>(ft) | Tension<br>Side | As Req'd<br>(in^2) | Governed<br>by | Actual As<br>(in^2) | Phi*Mn<br>(ft-k) | Mu / PhiMn |
|---------------------|--------------|-------------------------------|-----------------|--------------------|----------------|---------------------|------------------|------------|
| +1.20D+1.60L        | 0.010        | 2.040                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.000      |
| +1.20D+1.60L        | 0.014        | 2.050                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.017        | 2.060                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.021        | 2.070                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.025        | 2.080                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.030        | 2.090                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.035        | 2.100                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.040        | 2.110                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.045        | 2.120                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.051        | 2.130                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.057        | 2.140                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.063        | 2.150                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.070        | 2.160                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.077        | 2.170                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.084        | 2.180                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.004      |
| +1.20D+1.60L        | 0.092        | 2.190                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.004      |
| +1.20D+1.60L        | 0.100        | 2.200                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.004      |
| +1.20D+1.60L        | 0.108        | 2.210                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.005      |
| +1.20D+1.60L        | 0.116        | 2.220                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.005      |
| +1.20D+1.60L        | 0.125        | 2.230                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.005      |
| +1.20D+1.60L        | 0.134        | 2.240                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.006      |
| +1.20D+1.60L        | 0.143        | 2.250                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.006      |
| +1.20D+1.60L        | 0.153        | 2.260                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.007      |
| +1.20D+1.60L        | 0.163        | 2.270                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.007      |
| +1.20D+1.60L        | 0.173        | 2.280                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.007      |
| +1.20D+1.60L        | 0.184        | 2.290                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.008      |
| +1.20D+1.60L        | 0.195        | 2.300                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.008      |
| +1.20D+1.60L        | 0.206        | 2.310                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.009      |
| +1.20D+1.60L        | 0.217        | 2.320                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.009      |
| +1.20D+1.60L        | 0.229        | 2.330                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.010      |
| +1.20D+1.60L        | 0.241        | 2.340                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.010      |
| +1.20D+1.60L        | 0.253        | 2.350                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.011      |
| +1.20D+1.60L        | 0.266        | 2.360                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.011      |
| +1.20D+1.60L        | 0.279        | 2.370                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.012      |
| +1.20D+1.60L        | 0.292        | 2.380                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.012      |
| +1.20D+1.60L        | 0.306        | 2.390                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.013      |
| +1.20D+1.60L        | 0.320        | 2.400                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.014      |
| +1.20D+1.60L        | 0.334        | 2.410                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.014      |
| +1.20D+1.60L        | 0.349        | 2.420                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.015      |
| +1.20D+1.60L        | 0.364        | 2.430                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.015      |
| +1.20D+1.60L        | 0.379        | 2.440                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.016      |
| +1.20D+1.60L        | 0.394        | 2.450                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.017      |
| +1.20D+1.60L        | 0.410        | 2.460                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.017      |
| +1.20D+1.60L        | 0.426        | 2.470                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.018      |
| +1.20D+1.60L        | 0.443        | 2.480                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.019      |
| +1.20D+1.60L        | 0.459        | 2.490                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.020      |
| +1.20D+1.60L        | 0.476        | 2.500                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.020      |
| +1.20D+1.60L        | 0.494        | 2.510                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.021      |
| +1.20D+1.60L        | 0.511        | 2.520                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.022      |
| +1.20D+1.60L        | 0.529        | 2.530                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.023      |
| +1.20D+1.60L        | 0.547        | 2.540                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.023      |
| +1.20D+1.60L        | 0.566        | 2.550                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.024      |
| +1.20D+1.60L        | 0.585        | 2.560                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.025      |
| +1.20D+1.60L        | 0.604        | 2.570                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.026      |
| +1.20D+1.60L        | 0.624        | 2.580                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.027      |
| +1.20D+1.60L        | 0.643        | 2.590                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.027      |
| +1.20D+1.60L        | 0.664        | 2.600                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.028      |
| +1.20D+1.60L        | 0.684        | 2.610                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.029      |
| +1.20D+1.60L        | 0.705        | 2.620                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.030      |
| +1.20D+1.60L        | 0.726        | 2.630                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.031      |
| +1.20D+1.60L        | 0.747        | 2.640                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.032      |
| +1.20D+1.60L        | 0.769        | 2.650                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.033      |
| +1.20D+1.60L        | 0.791        | 2.660                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.034      |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Combined Footing**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION: Rev 1 - Foundation F2 - Deck Spread Footing**

**Z-Axis Footing Flexure - Maximum Values for Load Combination**

| Load Combination... | Mu<br>(ft-k) | Distance<br>from left<br>(ft) | Tension<br>Side | As Req'd<br>(in^2) | Governed<br>by | Actual As<br>(in^2) | Phi*Mn<br>(ft-k) | Mu / PhiMn |
|---------------------|--------------|-------------------------------|-----------------|--------------------|----------------|---------------------|------------------|------------|
| +1.20D+1.60L        | 0.813        | 2.670                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.035      |
| +1.20D+1.60L        | 0.836        | 2.680                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.036      |
| +1.20D+1.60L        | 0.859        | 2.690                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.037      |
| +1.20D+1.60L        | 0.882        | 2.700                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.038      |
| +1.20D+1.60L        | 0.906        | 2.710                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.039      |
| +1.20D+1.60L        | 0.930        | 2.720                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.040      |
| +1.20D+1.60L        | 0.954        | 2.730                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.041      |
| +1.20D+1.60L        | 0.979        | 2.740                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.042      |
| +1.20D+1.60L        | 1.004        | 2.750                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.043      |
| +1.20D+1.60L        | 1.029        | 2.760                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.044      |
| +1.20D+1.60L        | 1.054        | 2.770                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.045      |
| +1.20D+1.60L        | 1.080        | 2.780                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.046      |
| +1.20D+1.60L        | 1.106        | 2.790                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.047      |
| +1.20D+1.60L        | 1.133        | 2.800                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.048      |
| +1.20D+1.60L        | 1.160        | 2.810                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.049      |
| +1.20D+1.60L        | 1.187        | 2.820                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.051      |
| +1.20D+1.60L        | 1.214        | 2.830                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.052      |
| +1.20D+1.60L        | 1.241        | 2.840                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.053      |
| +1.20D+1.60L        | 1.267        | 2.850                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.054      |
| +1.20D+1.60L        | 1.291        | 2.860                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.055      |
| +1.20D+1.60L        | 1.314        | 2.870                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.056      |
| +1.20D+1.60L        | 1.334        | 2.880                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.057      |
| +1.20D+1.60L        | 1.353        | 2.890                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.058      |
| +1.20D+1.60L        | 1.370        | 2.900                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.058      |
| +1.20D+1.60L        | 1.386        | 2.910                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.059      |
| +1.20D+1.60L        | 1.400        | 2.920                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.060      |
| +1.20D+1.60L        | 1.412        | 2.930                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.060      |
| +1.20D+1.60L        | 1.423        | 2.940                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.061      |
| +1.20D+1.60L        | 1.431        | 2.950                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.061      |
| +1.20D+1.60L        | 1.438        | 2.960                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.061      |
| +1.20D+1.60L        | 1.444        | 2.970                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.061      |
| +1.20D+1.60L        | 1.448        | 2.980                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.062      |
| +1.20D+1.60L        | 1.450        | 2.990                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.062      |
| +1.20D+1.60L        | 1.450        | 3.000                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.062      |
| +1.20D+1.60L        | 1.449        | 3.010                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.062      |
| +1.20D+1.60L        | 1.446        | 3.020                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.062      |
| +1.20D+1.60L        | 1.441        | 3.030                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.061      |
| +1.20D+1.60L        | 1.434        | 3.040                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.061      |
| +1.20D+1.60L        | 1.426        | 3.050                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.061      |
| +1.20D+1.60L        | 1.417        | 3.060                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.060      |
| +1.20D+1.60L        | 1.405        | 3.070                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.060      |
| +1.20D+1.60L        | 1.392        | 3.080                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.059      |
| +1.20D+1.60L        | 1.377        | 3.090                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.059      |
| +1.20D+1.60L        | 1.361        | 3.100                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.058      |
| +1.20D+1.60L        | 1.342        | 3.110                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.057      |
| +1.20D+1.60L        | 1.322        | 3.120                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.056      |
| +1.20D+1.60L        | 1.301        | 3.130                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.055      |
| +1.20D+1.60L        | 1.278        | 3.140                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.054      |
| +1.20D+1.60L        | 1.253        | 3.150                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.053      |
| +1.20D+1.60L        | 1.226        | 3.160                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.052      |
| +1.20D+1.60L        | 1.198        | 3.170                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.051      |
| +1.20D+1.60L        | 1.169        | 3.180                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.050      |
| +1.20D+1.60L        | 1.141        | 3.190                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.049      |
| +1.20D+1.60L        | 1.114        | 3.200                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.047      |
| +1.20D+1.60L        | 1.086        | 3.210                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.046      |
| +1.20D+1.60L        | 1.059        | 3.220                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.045      |
| +1.20D+1.60L        | 1.033        | 3.230                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.044      |
| +1.20D+1.60L        | 1.006        | 3.240                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.043      |
| +1.20D+1.60L        | 0.980        | 3.250                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.042      |
| +1.20D+1.60L        | 0.954        | 3.260                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.041      |
| +1.20D+1.60L        | 0.929        | 3.270                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.040      |
| +1.20D+1.60L        | 0.904        | 3.280                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.038      |
| +1.20D+1.60L        | 0.879        | 3.290                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.037      |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Combined Footing**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION: Rev 1 - Foundation F2 - Deck Spread Footing**

**Z-Axis Footing Flexure - Maximum Values for Load Combination**

| Load Combination... | Mu<br>(ft-k) | Distance<br>from left<br>(ft) | Tension<br>Side | As Req'd<br>(in^2) | Governed<br>by | Actual As<br>(in^2) | Phi*Mn<br>(ft-k) | Mu / PhiMn |
|---------------------|--------------|-------------------------------|-----------------|--------------------|----------------|---------------------|------------------|------------|
| +1.20D+1.60L        | 0.855        | 3.300                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.036      |
| +1.20D+1.60L        | 0.831        | 3.310                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.035      |
| +1.20D+1.60L        | 0.807        | 3.320                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.034      |
| +1.20D+1.60L        | 0.784        | 3.330                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.033      |
| +1.20D+1.60L        | 0.761        | 3.340                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.032      |
| +1.20D+1.60L        | 0.738        | 3.350                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.031      |
| +1.20D+1.60L        | 0.716        | 3.360                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.030      |
| +1.20D+1.60L        | 0.694        | 3.370                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.030      |
| +1.20D+1.60L        | 0.672        | 3.380                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.029      |
| +1.20D+1.60L        | 0.651        | 3.390                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.028      |
| +1.20D+1.60L        | 0.630        | 3.400                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.027      |
| +1.20D+1.60L        | 0.609        | 3.410                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.026      |
| +1.20D+1.60L        | 0.589        | 3.420                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.025      |
| +1.20D+1.60L        | 0.569        | 3.430                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.024      |
| +1.20D+1.60L        | 0.549        | 3.440                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.023      |
| +1.20D+1.60L        | 0.530        | 3.450                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.023      |
| +1.20D+1.60L        | 0.511        | 3.460                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.022      |
| +1.20D+1.60L        | 0.493        | 3.470                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.021      |
| +1.20D+1.60L        | 0.474        | 3.480                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.020      |
| +1.20D+1.60L        | 0.456        | 3.490                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.019      |
| +1.20D+1.60L        | 0.439        | 3.500                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.019      |
| +1.20D+1.60L        | 0.421        | 3.510                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.018      |
| +1.20D+1.60L        | 0.405        | 3.520                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.017      |
| +1.20D+1.60L        | 0.388        | 3.530                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.017      |
| +1.20D+1.60L        | 0.372        | 3.540                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.016      |
| +1.20D+1.60L        | 0.356        | 3.550                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.015      |
| +1.20D+1.60L        | 0.340        | 3.560                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.014      |
| +1.20D+1.60L        | 0.325        | 3.570                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.014      |
| +1.20D+1.60L        | 0.310        | 3.580                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.013      |
| +1.20D+1.60L        | 0.296        | 3.590                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.013      |
| +1.20D+1.60L        | 0.282        | 3.600                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.012      |
| +1.20D+1.60L        | 0.268        | 3.610                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.011      |
| +1.20D+1.60L        | 0.254        | 3.620                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.011      |
| +1.20D+1.60L        | 0.241        | 3.630                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.010      |
| +1.20D+1.60L        | 0.228        | 3.640                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.010      |
| +1.20D+1.60L        | 0.216        | 3.650                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.009      |
| +1.20D+1.60L        | 0.204        | 3.660                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.009      |
| +1.20D+1.60L        | 0.192        | 3.670                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.008      |
| +1.20D+1.60L        | 0.181        | 3.680                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.008      |
| +1.20D+1.60L        | 0.170        | 3.690                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.007      |
| +1.20D+1.60L        | 0.159        | 3.700                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.007      |
| +1.20D+1.60L        | 0.148        | 3.710                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.006      |
| +1.20D+1.60L        | 0.138        | 3.720                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.006      |
| +1.20D+1.60L        | 0.129        | 3.730                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.005      |
| +1.20D+1.60L        | 0.119        | 3.740                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.005      |
| +1.20D+1.60L        | 0.110        | 3.750                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.005      |
| +1.20D+1.60L        | 0.102        | 3.760                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.004      |
| +1.20D+1.60L        | 0.094        | 3.770                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.004      |
| +1.20D+1.60L        | 0.086        | 3.780                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.004      |
| +1.20D+1.60L        | 0.078        | 3.790                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.071        | 3.800                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.064        | 3.810                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.003      |
| +1.20D+1.60L        | 0.057        | 3.820                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.051        | 3.830                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.045        | 3.840                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.040        | 3.850                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.002      |
| +1.20D+1.60L        | 0.035        | 3.860                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.030        | 3.870                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.026        | 3.880                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.021        | 3.890                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.018        | 3.900                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.014        | 3.910                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.001      |
| +1.20D+1.60L        | 0.011        | 3.920                         | Bottom          | 0.389              | Min Temp %     | 0.800               | 23.498           | 0.000      |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Combined Footing**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION: Rev 1 - Foundation F2 - Deck Spread Footing**

**Z-Axis Footing Flexure - Maximum Values for Load Combination**

| Load Combination... | Mu<br>(ft-k) | Distance<br>from left<br>(ft) | Tension<br>Side | As Req'd<br>(in^2) | Governed<br>by | Actual As<br>(in^2) | Phi*Mn<br>(ft-k) | Mu / PhiMn |
|---------------------|--------------|-------------------------------|-----------------|--------------------|----------------|---------------------|------------------|------------|
| +1.20D+1.60L        | 0.000        | 3.930                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 3.940                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 3.950                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 3.960                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 3.970                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 3.980                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 3.990                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |
| +1.20D+1.60L        | 0.000        | 4.000                         | 0               | 0.000              | 0              | 0.000               | 0.000            | 0.000      |

**One Way Shear**

**Punching Shear**

| Load Combination... | Phi Vn    | vu @ Col #1 | vu @ Col #2 | Phi Vn     | vu @ Col #1 | vu @ Col #2 |
|---------------------|-----------|-------------|-------------|------------|-------------|-------------|
| +1.40D              | 75.00 psi | 0.39 psi    | 0.39 psi    | 150.00 psi | 4.61 psi    | 4.27 psi    |
| +1.20D+1.60L        | 75.00 psi | 0.56 psi    | 0.56 psi    | 150.00 psi | 7.02 psi    | 6.54 psi    |
| +1.20D+L            | 75.00 psi | 0.47 psi    | 0.47 psi    | 150.00 psi | 5.87 psi    | 5.46 psi    |
| +1.20D              | 75.00 psi | 0.33 psi    | 0.33 psi    | 150.00 psi | 3.95 psi    | 3.66 psi    |
| +0.90D              | 75.00 psi | 0.25 psi    | 0.25 psi    | 150.00 psi | 2.96 psi    | 2.75 psi    |



## General Footing

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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### DESCRIPTION: Rev 1 - Foundation F3 - Existing Spread Footing

#### Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : ASCE 7-16

#### General Information

##### Material Properties

|                                |   |             |
|--------------------------------|---|-------------|
| f'c : Concrete 28 day strength | = | 2.50 ksi    |
| fy : Rebar Yield               | = | 40.0 ksi    |
| Ec : Concrete Elastic Modulus  | = | 3,122.0 ksi |
| Concrete Density               | = | 145.0 pcf   |
| φ Values Flexure               | = | 0.90        |
| Shear                          | = | 0.750       |

##### Soil Design Values

|                                       |   |           |
|---------------------------------------|---|-----------|
| Allowable Soil Bearing                | = | 2.0 ksf   |
| Soil Density                          | = | 110.0 pcf |
| Increase Bearing By Footing Weight    | = | Yes       |
| Soil Passive Resistance (for Sliding) | = | 350.0 pcf |
| Soil/Concrete Friction Coeff.         | = | 0.350     |

##### Analysis Settings

|  |   |         |
|--|---|---------|
| Min Steel % Bending Reinf.                 | = |         |
| Min Allow % Temp Reinf.                    | = | 0.00180 |
| Min. Overturning Safety Factor             | = | 1.0 : 1 |
| Min. Sliding Safety Factor                 | = | 1.0 : 1 |
| Add Ftg Wt for Soil Pressure               | : | Yes     |
| Use ftg wt for stability, moments & shears | : | Yes     |
| Add Pedestal Wt for Soil Pressure          | : | No      |
| Use Pedestal wt for stability, mom & shear | : | No      |

##### Increases based on footing Depth

|  |   |         |
|--|---|---------|
| Footing base depth below soil surface                              | = | 1.50 ft |
| Allow press. increase per foot of depth when footing base is below | = | ksf ft  |

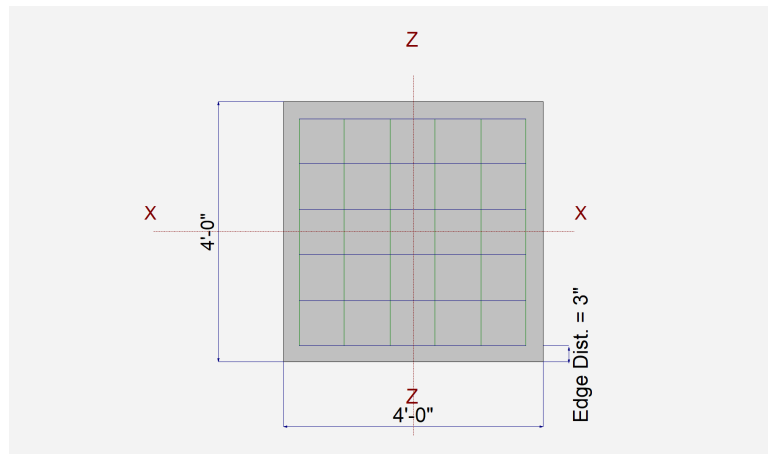
##### Increases based on footing plan dimension

|   |   |        |
|---|---|--------|
| Allowable pressure increase per foot of depth when max. length or width is greater than | = | ksf ft |
|---|---|--------|

#### Dimensions

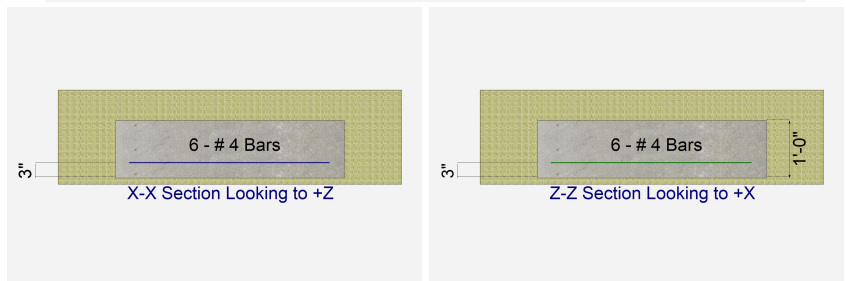
|                             |   |         |
|-----------------------------|---|---------|
| Width parallel to X-X Axis  | = | 4.0 ft  |
| Length parallel to Z-Z Axis | = | 4.0 ft  |
| Footing Thickness           | = | 12.0 in |

|  |   |        |
|--|---|--------|
| Pedestal dimensions...                                       | = |        |
| px : parallel to X-X Axis                                    | = | in     |
| pz : parallel to Z-Z Axis                                    | = | in     |
| Height   | = | in     |
| Rebar Centerline to Edge of Concrete... at Bottom of footing | = | 3.0 in |



#### Reinforcing

|   |   |     |
|---|---|-----|
| Bars parallel to X-X Axis                   | = |     |
| Number of Bars                              | = | 6.0 |
| Reinforcing Bar Size                        | = | # 4 |
| Bars parallel to Z-Z Axis                   | = |     |
| Number of Bars                              | = | 6   |
| Reinforcing Bar Size                        | = | # 4 |
| Bandwidth Distribution Check (ACI 15.4.4.2) |   |     |
| Direction Requiring Closer Separation       |   | n/a |
| # Bars required within zone                 |   | n/a |
| # Bars required on each side of zone        |   | n/a |



#### Applied Loads

|                 | D | Lr   | L | S     | W    | E | H    |
|-----------------|---|------|---|-------|------|---|------|
| P : Column Load | = | 11.0 |   | 13.90 | 3.20 |   | k    |
| OB : Overburden | = |      |   |       |      |   | ksf  |
| M-xx            | = |      |   |       |      |   | k-ft |
| M-zz            | = |      |   |       |      |   | k-ft |
| V-x             | = |      |   |       |      |   | k    |
| V-z             | = |      |   |       |      |   | k    |

**General Footing**

**DESCRIPTION: Rev 1 - Foundation F3 - Existing Spread Footing**

**DESIGN SUMMARY**

**Design OK**

|      | Min. Ratio | Item              | Applied       | Capacity      | Governing Load Combination |
|------|------------|-------------------|---------------|---------------|----------------------------|
| PASS | 0.8186     | Soil Bearing      | 1.756 ksf     | 2.145 ksf     | +D+L about Z-Z axis        |
| PASS | n/a        | Overturning - X-X | 0.0 k-ft      | 0.0 k-ft      | No Overturning             |
| PASS | n/a        | Overturning - Z-Z | 0.0 k-ft      | 0.0 k-ft      | No Overturning             |
| PASS | n/a        | Sliding - X-X     | 0.0 k         | 0.0 k         | No Sliding                 |
| PASS | n/a        | Sliding - Z-Z     | 0.0 k         | 0.0 k         | No Sliding                 |
| PASS | n/a        | Uplift            | 0.0 k         | 0.0 k         | No Uplift                  |
| PASS | 0.5870     | Z Flexure (+X)    | 4.630 k-ft/ft | 7.888 k-ft/ft | +1.20D+1.60L+0.50S         |
| PASS | 0.5870     | Z Flexure (-X)    | 4.630 k-ft/ft | 7.888 k-ft/ft | +1.20D+1.60L+0.50S         |
| PASS | 0.5870     | X Flexure (+Z)    | 4.630 k-ft/ft | 7.888 k-ft/ft | +1.20D+1.60L+0.50S         |
| PASS | 0.5870     | X Flexure (-Z)    | 4.630 k-ft/ft | 7.888 k-ft/ft | +1.20D+1.60L+0.50S         |
| PASS | 0.3544     | 1-way Shear (+X)  | 26.580 psi    | 75.0 psi      | +1.20D+1.60L+0.50S         |
| PASS | 0.3544     | 1-way Shear (-X)  | 26.580 psi    | 75.0 psi      | +1.20D+1.60L+0.50S         |
| PASS | 0.3544     | 1-way Shear (+Z)  | 26.580 psi    | 75.0 psi      | +1.20D+1.60L+0.50S         |
| PASS | 0.3544     | 1-way Shear (-Z)  | 26.580 psi    | 75.0 psi      | +1.20D+1.60L+0.50S         |
| PASS | 0.7374     | 2-way Punching    | 110.617 psi   | 150.0 psi     | +1.20D+1.60L+0.50S         |

**Detailed Results**

**Soil Bearing**

| Rotation Axis & Load Combination... | Gross Allowable | Xeccc | Zeccc (in) | Actual Soil Bearing Stress @ Location |         |          |           | Actual / Allow Ratio |
|-------------------------------------|-----------------|-------|------------|---------------------------------------|---------|----------|-----------|----------------------|
|                                     |                 |       |            | Bottom, -Z                            | Top, +Z | Left, -X | Right, +X |                      |
| X-X, D Only                         | 2.145           | n/a   | 0.0        | 0.8875                                | 0.8875  | n/a      | n/a       | 0.414                |
| X-X, +D+L                           | 2.145           | n/a   | 0.0        | 1.756                                 | 1.756   | n/a      | n/a       | 0.819                |
| X-X, +D+S                           | 2.145           | n/a   | 0.0        | 1.088                                 | 1.088   | n/a      | n/a       | 0.507                |
| X-X, +D+0.750L                      | 2.145           | n/a   | 0.0        | 1.539                                 | 1.539   | n/a      | n/a       | 0.718                |
| X-X, +D+0.750L+0.750S               | 2.145           | n/a   | 0.0        | 1.689                                 | 1.689   | n/a      | n/a       | 0.787                |
| X-X, +0.60D                         | 2.145           | n/a   | 0.0        | 0.5325                                | 0.5325  | n/a      | n/a       | 0.248                |
| Z-Z, D Only                         | 2.145           | 0.0   | n/a        | n/a                                   | n/a     | 0.8875   | 0.8875    | 0.414                |
| Z-Z, +D+L                           | 2.145           | 0.0   | n/a        | n/a                                   | n/a     | 1.756    | 1.756     | 0.819                |
| Z-Z, +D+S                           | 2.145           | 0.0   | n/a        | n/a                                   | n/a     | 1.088    | 1.088     | 0.507                |
| Z-Z, +D+0.750L                      | 2.145           | 0.0   | n/a        | n/a                                   | n/a     | 1.539    | 1.539     | 0.718                |
| Z-Z, +D+0.750L+0.750S               | 2.145           | 0.0   | n/a        | n/a                                   | n/a     | 1.689    | 1.689     | 0.787                |
| Z-Z, +0.60D                         | 2.145           | 0.0   | n/a        | n/a                                   | n/a     | 0.5325   | 0.5325    | 0.248                |

**Overturning Stability**

| Rotation Axis & Load Combination... | Overturning Moment | Resisting Moment | Stability Ratio | Status |
|-------------------------------------|--------------------|------------------|-----------------|--------|
| Footing Has NO Overturning          |                    |                  |                 |        |

All units k

**Sliding Stability**

| Force Application Axis Load Combination... | Sliding Force | Resisting Force | Stability Ratio | Status |
|--|---------------|-----------------|-----------------|--------|
| Footing Has NO Sliding                     |               |                 |                 |        |

**Footing Flexure**

| Flexure Axis & Load Combination | Mu k-ft | Side | Tension Surface | As Req'd in^2 | Gvrn. As in^2 | Actual As in^2 | Phi*Mn k-ft | Status |
|---------------------------------|---------|------|-----------------|---------------|---------------|----------------|-------------|--------|
| X-X, +1.40D                     | 1.925   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.40D                     | 1.925   | -Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+1.60L               | 4.430   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+1.60L               | 4.430   | -Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+1.60L+0.50S         | 4.630   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+1.60L+0.50S         | 4.630   | -Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+L                   | 3.388   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+L                   | 3.388   | -Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D                     | 1.650   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D                     | 1.650   | -Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+L+1.60S             | 4.028   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+L+1.60S             | 4.028   | -Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |
| X-X, +1.20D+1.60S               | 2.290   | +Z   | Bottom          | 0.2592        | AsMin         | 0.30           | 7.888       | OK     |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**General Footing**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION: Rev 1 - Foundation F3 - Existing Spread Footing**

**Footing Flexure**

| Flexure Axis & Load Combination | Mu<br>k-ft | Side | Tension<br>Surface | As Req'd<br>in^2 | Gvrn. As<br>in^2 | Actual As<br>in^2 | Phi*Mn<br>k-ft | Status |
|---------------------------------|------------|------|--------------------|------------------|------------------|-------------------|----------------|--------|
| X-X, +1.20D+1.60S               | 2.290      | -Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| X-X, +1.20D+L+0.50S             | 3.588      | +Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| X-X, +1.20D+L+0.50S             | 3.588      | -Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| X-X, +0.90D                     | 1.238      | +Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| X-X, +0.90D                     | 1.238      | -Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| X-X, +1.20D+L+0.20S             | 3.468      | +Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| X-X, +1.20D+L+0.20S             | 3.468      | -Z   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.40D                     | 1.925      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.40D                     | 1.925      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L               | 4.430      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L               | 4.430      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L+0.50S         | 4.630      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L+0.50S         | 4.630      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L                   | 3.388      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L                   | 3.388      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D                     | 1.650      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D                     | 1.650      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+1.60S             | 4.028      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+1.60S             | 4.028      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60S               | 2.290      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60S               | 2.290      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.50S             | 3.588      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.50S             | 3.588      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +0.90D                     | 1.238      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +0.90D                     | 1.238      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.20S             | 3.468      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.20S             | 3.468      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |

**One Way Shear**

| Load Combination... | Vu @ -X   | Vu @ +X   | Vu @ -Z   | Vu @ +Z   | Vu:Max    | Phi Vn    | Vu / Phi*Vn | Status |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|--------|
| +1.40D              | 11.05 psi | 11.05 psi | 11.05 psi | 11.05 psi | 11.05 psi | 75.00 psi | 0.15        | OK     |
| +1.20D+1.60L        | 25.43 psi | 25.43 psi | 25.43 psi | 25.43 psi | 25.43 psi | 75.00 psi | 0.34        | OK     |
| +1.20D+1.60L+0.50S  | 26.58 psi | 26.58 psi | 26.58 psi | 26.58 psi | 26.58 psi | 75.00 psi | 0.35        | OK     |
| +1.20D+L            | 19.45 psi | 19.45 psi | 19.45 psi | 19.45 psi | 19.45 psi | 75.00 psi | 0.26        | OK     |
| +1.20D              | 9.47 psi  | 9.47 psi  | 9.47 psi  | 9.47 psi  | 9.47 psi  | 75.00 psi | 0.13        | OK     |
| +1.20D+L+1.60S      | 23.12 psi | 23.12 psi | 23.12 psi | 23.12 psi | 23.12 psi | 75.00 psi | 0.31        | OK     |
| +1.20D+1.60S        | 13.15 psi | 13.15 psi | 13.15 psi | 13.15 psi | 13.15 psi | 75.00 psi | 0.18        | OK     |
| +1.20D+L+0.50S      | 20.60 psi | 20.60 psi | 20.60 psi | 20.60 psi | 20.60 psi | 75.00 psi | 0.27        | OK     |
| +0.90D              | 7.10 psi  | 7.10 psi  | 7.10 psi  | 7.10 psi  | 7.10 psi  | 75.00 psi | 0.09        | OK     |
| +1.20D+L+0.20S      | 19.91 psi | 19.91 psi | 19.91 psi | 19.91 psi | 19.91 psi | 75.00 psi | 0.27        | OK     |

All units k

**Two-Way "Punching" Shear**

| Load Combination... | Vu         | Phi*Vn    | Vu / Phi*Vn | Status |
|---------------------|------------|-----------|-------------|--------|
| +1.40D              | 45.99 psi  | 150.00psi | 0.3066      | OK     |
| +1.20D+1.60L        | 105.84 psi | 150.00psi | 0.7056      | OK     |
| +1.20D+1.60L+0.50S  | 110.62 psi | 150.00psi | 0.7374      | OK     |
| +1.20D+L            | 80.93 psi  | 150.00psi | 0.5395      | OK     |
| +1.20D              | 39.42 psi  | 150.00psi | 0.2628      | OK     |
| +1.20D+L+1.60S      | 96.22 psi  | 150.00psi | 0.6415      | OK     |
| +1.20D+1.60S        | 54.71 psi  | 150.00psi | 0.3647      | OK     |
| +1.20D+L+0.50S      | 85.71 psi  | 150.00psi | 0.5714      | OK     |
| +0.90D              | 29.57 psi  | 150.00psi | 0.1971      | OK     |
| +1.20D+L+0.20S      | 82.84 psi  | 150.00psi | 0.5523      | OK     |

## General Footing

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

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### DESCRIPTION: Rev 1 - Foundation F4 - Spread Footing at Deck

### Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : ASCE 7-16

### General Information

#### Material Properties

|                                |   |             |
|--------------------------------|---|-------------|
| f'c : Concrete 28 day strength | = | 2.50 ksi    |
| fy : Rebar Yield               | = | 40.0 ksi    |
| Ec : Concrete Elastic Modulus  | = | 3,122.0 ksi |
| Concrete Density               | = | 145.0 pcf   |
| φ Values Flexure               | = | 0.90        |
| Shear                          | = | 0.750       |

#### Soil Design Values

|                                       |   |           |
|---------------------------------------|---|-----------|
| Allowable Soil Bearing                | = | 2.0 ksf   |
| Soil Density                          | = | 110.0 pcf |
| Increase Bearing By Footing Weight    | = | Yes       |
| Soil Passive Resistance (for Sliding) | = | 350.0 pcf |
| Soil/Concrete Friction Coeff.         | = | 0.350     |

#### Analysis Settings

|  |   |         |
|--|---|---------|
| Min Steel % Bending Reinf.                 | = |         |
| Min Allow % Temp Reinf.                    | = | 0.00180 |
| Min. Overturning Safety Factor             | = | 1.0 : 1 |
| Min. Sliding Safety Factor                 | = | 1.0 : 1 |
| Add Ftg Wt for Soil Pressure               | : | Yes     |
| Use ftg wt for stability, moments & shears | : | Yes     |
| Add Pedestal Wt for Soil Pressure          | : | No      |
| Use Pedestal wt for stability, mom & shear | : | No      |

#### Increases based on footing Depth

|  |   |         |
|--|---|---------|
| Footing base depth below soil surface                              | = | 1.50 ft |
| Allow press. increase per foot of depth when footing base is below | = | ksf ft  |

#### Increases based on footing plan dimension

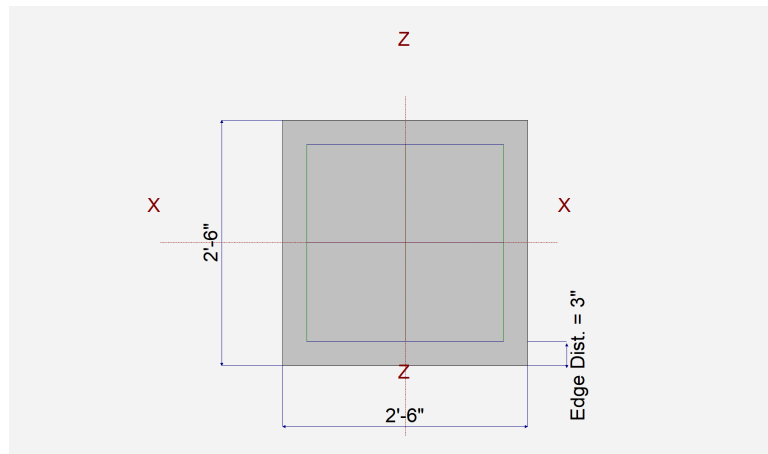
|   |   |        |
|---|---|--------|
| Allowable pressure increase per foot of depth when max. length or width is greater than | = | ksf ft |
|---|---|--------|

### Dimensions

|                             |   |         |
|-----------------------------|---|---------|
| Width parallel to X-X Axis  | = | 2.50 ft |
| Length parallel to Z-Z Axis | = | 2.50 ft |
| Footing Thickness           | = | 10.0 in |

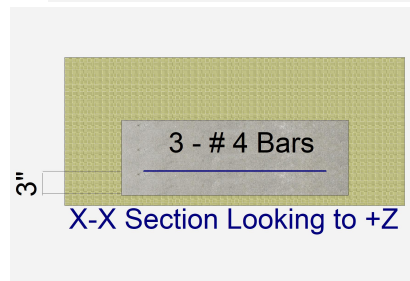
#### Pedestal dimensions...

|  |   |        |
|--|---|--------|
| px : parallel to X-X Axis                                    | = | in     |
| pz : parallel to Z-Z Axis                                    | = | in     |
| Height   | = | in     |
| Rebar Centerline to Edge of Concrete... at Bottom of footing | = | 3.0 in |



### Reinforcing

|   |   |     |
|---|---|-----|
| Bars parallel to X-X Axis                   |   |     |
| Number of Bars                              | = | 3   |
| Reinforcing Bar Size                        | = | # 4 |
| Bars parallel to Z-Z Axis                   |   |     |
| Number of Bars                              | = | 3   |
| Reinforcing Bar Size                        | = | # 4 |
| Bandwidth Distribution Check (ACI 15.4.4.2) |   |     |
| Direction Requiring Closer Separation       |   | n/a |
| # Bars required within zone                 |   | n/a |
| # Bars required on each side of zone        |   | n/a |



### Applied Loads

|                 | D | Lr   | L | S    | W   | E | H    |
|-----------------|---|------|---|------|-----|---|------|
| P : Column Load | = | 2.60 |   | 6.80 | 0.0 |   | k    |
| OB : Overburden | = |      |   |      |     |   | ksf  |
| M-xx            | = |      |   |      |     |   | k-ft |
| M-zz            | = |      |   |      |     |   | k-ft |
| V-x             | = |      |   |      |     |   | k    |
| V-z             | = |      |   |      |     |   | k    |

**General Footing**

**DESCRIPTION: Rev 1 - Foundation F4 - Spread Footing at Deck**

**DESIGN SUMMARY**

**Design OK**

|      | Min. Ratio | Item              | Applied       | Capacity      | Governing Load Combination |
|------|------------|-------------------|---------------|---------------|----------------------------|
| PASS | 0.8006     | Soil Bearing      | 1.698 ksf     | 2.121 ksf     | +D+L about Z-Z axis        |
| PASS | n/a        | Overturning - X-X | 0.0 k-ft      | 0.0 k-ft      | No Overturning             |
| PASS | n/a        | Overturning - Z-Z | 0.0 k-ft      | 0.0 k-ft      | No Overturning             |
| PASS | n/a        | Sliding - X-X     | 0.0 k         | 0.0 k         | No Sliding                 |
| PASS | n/a        | Sliding - Z-Z     | 0.0 k         | 0.0 k         | No Sliding                 |
| PASS | n/a        | Uplift            | 0.0 k         | 0.0 k         | No Uplift                  |
| PASS | 0.3568     | Z Flexure (+X)    | 1.750 k-ft/ft | 4.904 k-ft/ft | +1.20D+1.60L               |
| PASS | 0.3568     | Z Flexure (-X)    | 1.750 k-ft/ft | 4.904 k-ft/ft | +1.20D+1.60L               |
| PASS | 0.3568     | X Flexure (+Z)    | 1.750 k-ft/ft | 4.904 k-ft/ft | +1.20D+1.60L               |
| PASS | 0.3568     | X Flexure (-Z)    | 1.750 k-ft/ft | 4.904 k-ft/ft | +1.20D+1.60L               |
| PASS | 0.240      | 1-way Shear (+X)  | 18.0 psi      | 75.0 psi      | +1.20D+1.60L               |
| PASS | 0.240      | 1-way Shear (-X)  | 18.0 psi      | 75.0 psi      | +1.20D+1.60L               |
| PASS | 0.240      | 1-way Shear (+Z)  | 18.0 psi      | 75.0 psi      | +1.20D+1.60L               |
| PASS | 0.240      | 1-way Shear (-Z)  | 18.0 psi      | 75.0 psi      | +1.20D+1.60L               |
| PASS | 0.4488     | 2-way Punching    | 67.314 psi    | 150.0 psi     | +1.20D+1.60L               |

**Detailed Results**

**Soil Bearing**

| Rotation Axis & Load Combination... | Gross Allowable | Xecc |      | Zecc       |         | Actual Soil Bearing Stress @ Location |           |  |  | Actual / Allow Ratio |
|-------------------------------------|-----------------|------|------|------------|---------|---------------------------------------|-----------|--|--|----------------------|
|                                     |                 |      | (in) | Bottom, -Z | Top, +Z | Left, -X                              | Right, +X |  |  |                      |
| X-X, D Only                         | 2.121           | n/a  | 0.0  | 0.6102     | 0.6102  | n/a                                   | n/a       |  |  | 0.288                |
| X-X, +D+L                           | 2.121           | n/a  | 0.0  | 1.698      | 1.698   | n/a                                   | n/a       |  |  | 0.801                |
| X-X, +D+0.750L                      | 2.121           | n/a  | 0.0  | 1.426      | 1.426   | n/a                                   | n/a       |  |  | 0.672                |
| X-X, +0.60D                         | 2.121           | n/a  | 0.0  | 0.3661     | 0.3661  | n/a                                   | n/a       |  |  | 0.173                |
| Z-Z, D Only                         | 2.121           | 0.0  | n/a  | n/a        | n/a     | 0.6102                                | 0.6102    |  |  | 0.288                |
| Z-Z, +D+L                           | 2.121           | 0.0  | n/a  | n/a        | n/a     | 1.698                                 | 1.698     |  |  | 0.801                |
| Z-Z, +D+0.750L                      | 2.121           | 0.0  | n/a  | n/a        | n/a     | 1.426                                 | 1.426     |  |  | 0.672                |
| Z-Z, +0.60D                         | 2.121           | 0.0  | n/a  | n/a        | n/a     | 0.3661                                | 0.3661    |  |  | 0.173                |

**Overturning Stability**

| Rotation Axis & Load Combination... | Overturning Moment | Resisting Moment | Stability Ratio | Status |
|-------------------------------------|--------------------|------------------|-----------------|--------|
| Footing Has NO Overturning          |                    |                  |                 |        |

All units k

**Sliding Stability**

| Force Application Axis Load Combination... | Sliding Force | Resisting Force | Stability Ratio | Status |
|--|---------------|-----------------|-----------------|--------|
| Footing Has NO Sliding                     |               |                 |                 |        |

**Footing Flexure**

| Flexure Axis & Load Combination | Mu k-ft | Side | Tension Surface | As Req'd in^2 | Gvrn. As in^2 | Actual As in^2 | Phi*Mn k-ft | Status |
|---------------------------------|---------|------|-----------------|---------------|---------------|----------------|-------------|--------|
| X-X, +1.40D                     | 0.4550  | +Z   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| X-X, +1.40D                     | 0.4550  | -Z   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| X-X, +1.20D+1.60L               | 1.750   | +Z   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| X-X, +1.20D+1.60L               | 1.750   | -Z   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| X-X, +1.20D+L                   | 1.240   | +Z   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| X-X, +1.20D+L                   | 1.240   | -Z   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| X-X, +1.20D                     | 0.390   | +Z   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| X-X, +1.20D                     | 0.390   | -Z   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| X-X, +0.90D                     | 0.2925  | +Z   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| X-X, +0.90D                     | 0.2925  | -Z   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| Z-Z, +1.40D                     | 0.4550  | -X   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| Z-Z, +1.40D                     | 0.4550  | +X   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| Z-Z, +1.20D+1.60L               | 1.750   | -X   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| Z-Z, +1.20D+1.60L               | 1.750   | +X   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| Z-Z, +1.20D+L                   | 1.240   | -X   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| Z-Z, +1.20D+L                   | 1.240   | +X   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |
| Z-Z, +1.20D                     | 0.390   | -X   | Bottom          | 0.2160        | AsMin         | 0.240          | 4.904       | OK     |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## General Footing

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

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### DESCRIPTION: Rev 1 - Foundation F4 - Spread Footing at Deck

#### Footing Flexure

| Flexure Axis & Load Combination | Mu<br>k-ft | Side | Tension<br>Surface | As Req'd<br>in <sup>2</sup> | Gvrn. As<br>in <sup>2</sup> | Actual As<br>in <sup>2</sup> | Phi*Mn<br>k-ft | Status |
|---------------------------------|------------|------|--------------------|-----------------------------|-----------------------------|------------------------------|----------------|--------|
| Z-Z, +1.20D                     | 0.390      | +X   | Bottom             | 0.2160                      | AsMin                       | 0.240                        | 4.904          | OK     |
| Z-Z, +0.90D                     | 0.2925     | -X   | Bottom             | 0.2160                      | AsMin                       | 0.240                        | 4.904          | OK     |
| Z-Z, +0.90D                     | 0.2925     | +X   | Bottom             | 0.2160                      | AsMin                       | 0.240                        | 4.904          | OK     |

#### One Way Shear

| Load Combination... | Vu @ -X   | Vu @ +X   | Vu @ -Z   | Vu @ +Z   | Vu:Max    | Phi Vn    | Vu / Phi*Vn | Status |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|--------|
| +1.40D              | 4.68 psi  | 4.68 psi  | 4.68 psi  | 4.68 psi  | 4.68 psi  | 75.00 psi | 0.06        | OK     |
| +1.20D+1.60L        | 18.00 psi | 18.00 psi | 18.00 psi | 18.00 psi | 18.00 psi | 75.00 psi | 0.24        | OK     |
| +1.20D+L            | 12.75 psi | 12.75 psi | 12.75 psi | 12.75 psi | 12.75 psi | 75.00 psi | 0.17        | OK     |
| +1.20D              | 4.01 psi  | 4.01 psi  | 4.01 psi  | 4.01 psi  | 4.01 psi  | 75.00 psi | 0.05        | OK     |
| +0.90D              | 3.01 psi  | 3.01 psi  | 3.01 psi  | 3.01 psi  | 3.01 psi  | 75.00 psi | 0.04        | OK     |

#### Two-Way "Punching" Shear

| Load Combination... | Vu        | Phi*Vn    | Vu / Phi*Vn | Status |
|---------------------|-----------|-----------|-------------|--------|
| +1.40D              | 17.50 psi | 150.00psi | 0.1167      | OK     |
| +1.20D+1.60L        | 67.31 psi | 150.00psi | 0.4488      | OK     |
| +1.20D+L            | 47.70 psi | 150.00psi | 0.318       | OK     |
| +1.20D              | 15.00 psi | 150.00psi | 0.1         | OK     |
| +0.90D              | 11.25 psi | 150.00psi | 0.07501     | OK     |

All units k

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## General Footing

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

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### DESCRIPTION: Rev 1 - Foundation F5 - Spread Footing at Deck Column

#### Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : ASCE 7-16

#### General Information

##### Material Properties

|                                |   |             |
|--------------------------------|---|-------------|
| f'c : Concrete 28 day strength | = | 2.50 ksi    |
| fy : Rebar Yield               | = | 40.0 ksi    |
| Ec : Concrete Elastic Modulus  | = | 3,122.0 ksi |
| Concrete Density               | = | 145.0 pcf   |
| φ Values Flexure               | = | 0.90        |
| Shear                          | = | 0.750       |

##### Soil Design Values

|                                       |   |           |
|---------------------------------------|---|-----------|
| Allowable Soil Bearing                | = | 2.670 ksf |
| Soil Density                          | = | 110.0 pcf |
| Increase Bearing By Footing Weight    | = | Yes       |
| Soil Passive Resistance (for Sliding) | = | 350.0 pcf |
| Soil/Concrete Friction Coeff.         | = | 0.350     |

##### Analysis Settings

|  |   |         |
|--|---|---------|
| Min Steel % Bending Reinf.                 | = |         |
| Min Allow % Temp Reinf.                    | = | 0.00180 |
| Min. Overturning Safety Factor             | = | 1.0 : 1 |
| Min. Sliding Safety Factor                 | = | 1.0 : 1 |
| Add Ftg Wt for Soil Pressure               | : | Yes     |
| Use ftg wt for stability, moments & shears | : | Yes     |
| Add Pedestal Wt for Soil Pressure          | : | No      |
| Use Pedestal wt for stability, mom & shear | : | No      |

##### Increases based on footing Depth

|  |   |        |
|--|---|--------|
| Footing base depth below soil surface                              | = | 2.0 ft |
| Allow press. increase per foot of depth when footing base is below | = | ksf ft |

##### Increases based on footing plan dimension

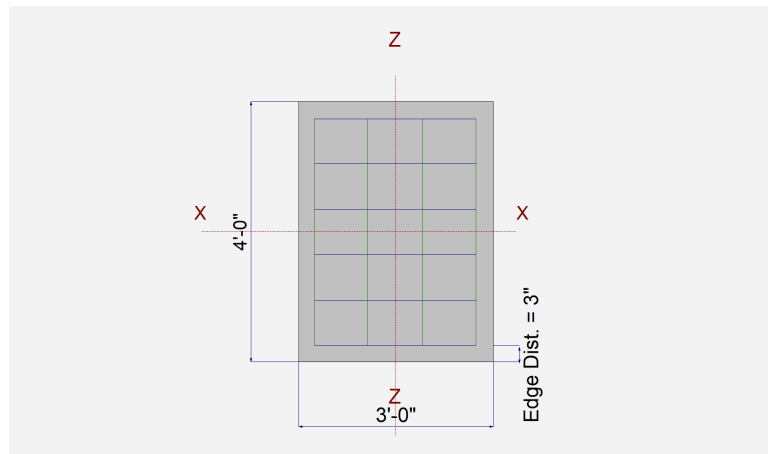
|   |   |        |
|---|---|--------|
| Allowable pressure increase per foot of depth when max. length or width is greater than | = | ksf ft |
|---|---|--------|

#### Dimensions

|                             |   |         |
|-----------------------------|---|---------|
| Width parallel to X-X Axis  | = | 3.0 ft  |
| Length parallel to Z-Z Axis | = | 4.0 ft  |
| Footing Thickness           | = | 12.0 in |

##### Pedestal dimensions...

|  |   |        |
|--|---|--------|
| px : parallel to X-X Axis                                    | = | in     |
| pz : parallel to Z-Z Axis                                    | = | in     |
| Height   | = | in     |
| Rebar Centerline to Edge of Concrete... at Bottom of footing | = | 3.0 in |

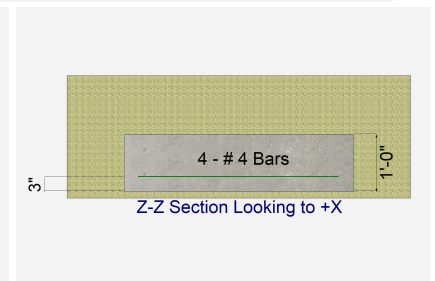
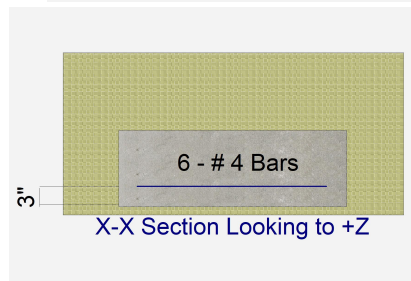


#### Reinforcing

|                           |   |     |
|---------------------------|---|-----|
| Bars parallel to X-X Axis | = |     |
| Number of Bars            | = | 6.0 |
| Reinforcing Bar Size      | = | # 4 |
| Bars parallel to Z-Z Axis | = |     |
| Number of Bars            | = | 4.0 |
| Reinforcing Bar Size      | = | # 4 |

##### Bandwidth Distribution Check (ACI 15.4.4.2)

|                                       |                     |  |
|---------------------------------------|---------------------|--|
| Direction Requiring Closer Separation |                     |  |
|                                       | Bars along X-X Axis |  |
| # Bars required within zone           | 85.7 %              |  |
| # Bars required on each side of zone  | 14.3 %              |  |



#### Applied Loads

|                 | D | Lr   | L | S   | W     | E | H    |      |
|-----------------|---|------|---|-----|-------|---|------|------|
| P : Column Load | = | 5.80 |   | 4.0 | 0.10  |   | 0.90 | k    |
| OB : Overburden | = |      |   |     |       |   |      | ksf  |
| M-xx            | = |      |   |     |       |   |      | k-ft |
| M-zz            | = |      |   |     |       |   |      | k-ft |
| V-x             | = |      |   |     |       |   |      | k    |
| V-z             | = | 0.50 |   |     | -0.10 |   | 4.40 | k    |

**General Footing**

**DESCRIPTION: Rev 1 - Foundation F5 - Spread Footing at Deck Column**

**DESIGN SUMMARY**

**Design OK**

|      | Min. Ratio | Item             | Applied       | Capacity      | Governing Load Combination       |
|------|------------|------------------|---------------|---------------|----------------------------------|
| PASS | 0.4874     | Soil Bearing     | 1.372 ksf     | 2.815 ksf     | +D+0.750L+0.750S+0.5250E about X |
| PASS | 3.518      | Overturing - X-X | 3.380 k-ft    | 11.892 k-ft   | +0.60D+0.70E                     |
| PASS | n/a        | Overturing - Z-Z | 0.0 k-ft      | 0.0 k-ft      | No Overturing                    |
| PASS | n/a        | Sliding - X-X    | 0.0 k         | 0.0 k         | No Sliding                       |
| PASS | 1.082      | Sliding - Z-Z    | 3.380 k       | 3.656 k       | +0.60D+0.70E                     |
| PASS | n/a        | Uplift           | 0.0 k         | 0.0 k         | No Uplift                        |
| PASS | 0.1594     | Z Flexure (+X)   | 1.257 k-ft/ft | 7.888 k-ft/ft | +1.20D+1.60L+0.50S               |
| PASS | 0.1594     | Z Flexure (-X)   | 1.257 k-ft/ft | 7.888 k-ft/ft | +1.20D+1.60L+0.50S               |
| PASS | 0.3996     | X Flexure (+Z)   | 2.810 k-ft/ft | 7.033 k-ft/ft | +1.20D+L+0.20S+E                 |
| PASS | 0.3048     | X Flexure (-Z)   | 2.143 k-ft/ft | 7.033 k-ft/ft | +1.20D+1.60L+0.50S               |
| PASS | 0.1035     | 1-way Shear (+X) | 7.760 psi     | 75.0 psi      | +1.20D+1.60L+0.50S               |
| PASS | 0.1035     | 1-way Shear (-X) | 7.760 psi     | 75.0 psi      | +1.20D+1.60L+0.50S               |
| PASS | 0.2173     | 1-way Shear (+Z) | 16.298 psi    | 75.0 psi      | +1.20D+L+0.20S+E                 |
| PASS | 0.1638     | 1-way Shear (-Z) | 12.286 psi    | 75.0 psi      | +1.20D+1.60L+0.50S               |
| PASS | 0.2635     | 2-way Punching   | 39.526 psi    | 150.0 psi     | +1.20D+1.60L+0.50S               |

**Detailed Results**

**Soil Bearing**

| Rotation Axis & Load Combination... | Gross Allowable | Xecc | Zecc (in) | Actual Soil Bearing Stress @ Location |         |          |           | Actual / Allow Ratio |
|-------------------------------------|-----------------|------|-----------|---------------------------------------|---------|----------|-----------|----------------------|
|                                     |                 |      |           | Bottom, -Z                            | Top, +Z | Left, -X | Right, +X |                      |
| X-X, D Only                         | 2.815           | n/a  | 0.6772    | 0.6765                                | 0.8002  | n/a      | n/a       | 0.284                |
| X-X, +D+L                           | 2.815           | n/a  | 0.4666    | 1.010                                 | 1.134   | n/a      | n/a       | 0.403                |
| X-X, +D+S                           | 2.815           | n/a  | 0.5357    | 0.6972                                | 0.7962  | n/a      | n/a       | 0.283                |
| X-X, +D+0.750L                      | 2.815           | n/a  | 0.5059    | 0.9265                                | 1.050   | n/a      | n/a       | 0.373                |
| X-X, +D+0.750L+0.750S               | 2.815           | n/a  | 0.4273    | 0.9420                                | 1.047   | n/a      | n/a       | 0.372                |
| X-X, +0.60D                         | 2.815           | n/a  | 0.6772    | 0.4059                                | 0.4801  | n/a      | n/a       | 0.171                |
| X-X, +D+0.70E                       | 2.815           | n/a  | 4.527     | 0.3478                                | 1.234   | n/a      | n/a       | 0.438                |
| X-X, +D+0.750L+0.750S+0.5250E       | 2.815           | n/a  | 2.645     | 0.6955                                | 1.372   | n/a      | n/a       | 0.487                |
| X-X, +0.60D+0.70E                   | 2.815           | n/a  | 6.821     | 0.07723                               | 0.9138  | n/a      | n/a       | 0.325                |
| Z-Z, D Only                         | 2.815           | 0.0  | n/a       | n/a                                   | n/a     | 0.7383   | 0.7383    | 0.262                |
| Z-Z, +D+L                           | 2.815           | 0.0  | n/a       | n/a                                   | n/a     | 1.072    | 1.072     | 0.381                |
| Z-Z, +D+S                           | 2.815           | 0.0  | n/a       | n/a                                   | n/a     | 0.7467   | 0.7467    | 0.265                |
| Z-Z, +D+0.750L                      | 2.815           | 0.0  | n/a       | n/a                                   | n/a     | 0.9883   | 0.9883    | 0.351                |
| Z-Z, +D+0.750L+0.750S               | 2.815           | 0.0  | n/a       | n/a                                   | n/a     | 0.9946   | 0.9946    | 0.353                |
| Z-Z, +0.60D                         | 2.815           | 0.0  | n/a       | n/a                                   | n/a     | 0.4430   | 0.4430    | 0.157                |
| Z-Z, +D+0.70E                       | 2.815           | 0.0  | n/a       | n/a                                   | n/a     | 0.7908   | 0.7908    | 0.281                |
| Z-Z, +D+0.750L+0.750S+0.5250E       | 2.815           | 0.0  | n/a       | n/a                                   | n/a     | 1.034    | 1.034     | 0.367                |
| Z-Z, +0.60D+0.70E                   | 2.815           | 0.0  | n/a       | n/a                                   | n/a     | 0.4955   | 0.4955    | 0.176                |

**Overturing Stability**

| Rotation Axis & Load Combination... | Overturing Moment | Resisting Moment | Stability Ratio | Status |
|-------------------------------------|-------------------|------------------|-----------------|--------|
| X-X, D Only                         | 0.50 k-ft         | 17.720 k-ft      | 35.440          | OK     |
| X-X, +D+L                           | 0.50 k-ft         | 25.720 k-ft      | 51.440          | OK     |
| X-X, +D+S                           | 0.50 k-ft         | 18.020 k-ft      | 36.040          | OK     |
| X-X, +D+0.750L                      | 0.50 k-ft         | 23.720 k-ft      | 47.440          | OK     |
| X-X, +D+0.750L+0.750S               | 0.50 k-ft         | 23.945 k-ft      | 47.890          | OK     |
| X-X, +0.60D                         | 0.30 k-ft         | 10.632 k-ft      | 35.440          | OK     |
| X-X, +D+0.70E                       | 3.580 k-ft        | 18.980 k-ft      | 5.302           | OK     |
| X-X, +D+0.750L+0.750S+0.5250E       | 2.810 k-ft        | 24.890 k-ft      | 8.858           | OK     |
| X-X, +0.60D+0.70E                   | 3.380 k-ft        | 11.892 k-ft      | 3.518           | OK     |
| Z-Z, D Only                         | None              | 0.0 k-ft         | Infinity        | OK     |
| Z-Z, +D+L                           | None              | 0.0 k-ft         | Infinity        | OK     |
| Z-Z, +D+S                           | None              | 0.0 k-ft         | Infinity        | OK     |
| Z-Z, +D+0.750L                      | None              | 0.0 k-ft         | Infinity        | OK     |
| Z-Z, +D+0.750L+0.750S               | None              | 0.0 k-ft         | Infinity        | OK     |
| Z-Z, +0.60D                         | None              | 0.0 k-ft         | Infinity        | OK     |
| Z-Z, +D+0.70E                       | None              | 0.0 k-ft         | Infinity        | OK     |
| Z-Z, +D+0.750L+0.750S+0.5250E       | None              | 0.0 k-ft         | Infinity        | OK     |
| Z-Z, +0.60D+0.70E                   | None              | 0.0 k-ft         | Infinity        | OK     |



Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**General Footing**

Project File: Hong Kao - Rev 1.ec6

LIC#: KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION: Rev 1 - Foundation F5 - Spread Footing at Deck Column**

All units k

**Sliding Stability**

| Force Application Axis<br>Load Combination... | Sliding Force | Resisting Force | Stability Ratio | Status |
|---|---------------|-----------------|-----------------|--------|
| X-X, D Only                                   | 0.0 k         | 5.201 k         | No Sliding      | OK     |
| X-X, +D+L                                     | 0.0 k         | 6.601 k         | No Sliding      | OK     |
| X-X, +D+S                                     | 0.0 k         | 5.236 k         | No Sliding      | OK     |
| X-X, +D+0.750L                                | 0.0 k         | 6.251 k         | No Sliding      | OK     |
| X-X, +D+0.750L+0.750S                         | 0.0 k         | 6.277 k         | No Sliding      | OK     |
| X-X, +0.60D                                   | 0.0 k         | 3.961 k         | No Sliding      | OK     |
| X-X, +D+0.70E                                 | 0.0 k         | 5.422 k         | No Sliding      | OK     |
| X-X, +D+0.750L+0.750S+0.5250E                 | 0.0 k         | 6.443 k         | No Sliding      | OK     |
| X-X, +0.60D+0.70E                             | 0.0 k         | 4.181 k         | No Sliding      | OK     |
| Z-Z, D Only                                   | 0.50 k        | 4.676 k         | 9.352           | OK     |
| Z-Z, +D+L                                     | 0.50 k        | 6.076 k         | 12.152          | OK     |
| Z-Z, +D+S                                     | 0.40 k        | 4.711 k         | 11.778          | OK     |
| Z-Z, +D+0.750L                                | 0.50 k        | 5.726 k         | 11.452          | OK     |
| Z-Z, +D+0.70E                                 | 3.580 k       | 4.897 k         | 1.368           | OK     |
| Z-Z, +D+0.750L+0.750S+0.5250E                 | 2.735 k       | 5.918 k         | 2.164           | OK     |
| Z-Z, +0.60D+0.70E                             | 3.380 k       | 3.656 k         | 1.082           | OK     |
| Z-Z, +D+0.750L+0.750S                         | 0.4250 k      | 5.752 k         | 13.535          | OK     |
| Z-Z, +0.60D                                   | 0.30 k        | 3.436 k         | 11.452          | OK     |

**Footing Flexure**

| Flexure Axis & Load Combination | Mu<br>k-ft | Side | Tension<br>Surface | As Req'd<br>in^2 | Gvrn. As<br>in^2 | Actual As<br>in^2 | Phi*Mn<br>k-ft | Status |
|---------------------------------|------------|------|--------------------|------------------|------------------|-------------------|----------------|--------|
| X-X, +1.40D                     | 1.470      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.40D                     | 1.237      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+1.60L               | 2.327      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+1.60L               | 2.127      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+1.60L+0.50S         | 2.327      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+1.60L+0.50S         | 2.143      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+L                   | 1.927      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+L                   | 1.727      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D                     | 1.260      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D                     | 1.060      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+L+1.60S             | 1.927      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+L+1.60S             | 1.780      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+1.60S               | 1.260      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+1.60S               | 1.113      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+L+0.50S             | 1.927      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+L+0.50S             | 1.743      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +0.90D                     | 0.9450     | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +0.90D                     | 0.7950     | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+L+0.20S+E           | 2.810      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+L+0.20S+E           | 1.150      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +0.90D+E                   | 1.828      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +0.90D+E                   | 0.2117     | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| Z-Z, +1.40D                     | 0.7613     | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.40D                     | 0.7613     | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L               | 1.253      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L               | 1.253      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L+0.50S         | 1.257      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L+0.50S         | 1.257      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L                   | 1.028      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L                   | 1.028      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D                     | 0.6525     | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D                     | 0.6525     | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+1.60S             | 1.043      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+1.60S             | 1.043      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60S               | 0.6675     | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60S               | 0.6675     | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.50S             | 1.032      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.50S             | 1.032      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +0.90D                     | 0.4894     | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +0.90D                     | 0.4894     | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.20S+E           | 1.114      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## General Footing

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

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### DESCRIPTION: Rev 1 - Foundation F5 - Spread Footing at Deck Column

#### Footing Flexure

| Flexure Axis & Load Combination | Mu<br>k-ft | Side | Tension<br>Surface | As Req'd<br>in <sup>2</sup> | Gvrn. As<br>in <sup>2</sup> | Actual As<br>in <sup>2</sup> | Phi*Mn<br>k-ft | Status |
|---------------------------------|------------|------|--------------------|-----------------------------|-----------------------------|------------------------------|----------------|--------|
| Z-Z, +1.20D+L+0.20S+E           | 1.114      | +X   | Bottom             | 0.2592                      | AsMin                       | 0.30                         | 7.888          | OK     |
| Z-Z, +0.90D+E                   | 0.5738     | -X   | Bottom             | 0.2592                      | AsMin                       | 0.30                         | 7.888          | OK     |
| Z-Z, +0.90D+E                   | 0.5738     | +X   | Bottom             | 0.2592                      | AsMin                       | 0.30                         | 7.888          | OK     |

#### One Way Shear

| Load Combination... | Vu @ -X  | Vu @ +X  | Vu @ -Z   | Vu @ +Z   | Vu:Max    | Phi Vn    | Vu / Phi*Vn | Status |
|---------------------|----------|----------|-----------|-----------|-----------|-----------|-------------|--------|
| +1.40D              | 4.70 psi | 4.70 psi | 7.08 psi  | 8.46 psi  | 8.46 psi  | 75.00 psi | 0.11        | OK     |
| +1.20D+1.60L        | 7.73 psi | 7.73 psi | 12.19 psi | 13.38 psi | 13.38 psi | 75.00 psi | 0.18        | OK     |
| +1.20D+1.60L+0.50S  | 7.76 psi | 7.76 psi | 12.29 psi | 13.38 psi | 13.38 psi | 75.00 psi | 0.18        | OK     |
| +1.20D+L            | 6.34 psi | 6.34 psi | 9.89 psi  | 11.08 psi | 11.08 psi | 75.00 psi | 0.15        | OK     |
| +1.20D              | 4.03 psi | 4.03 psi | 6.07 psi  | 7.25 psi  | 7.25 psi  | 75.00 psi | 0.10        | OK     |
| +1.20D+L+1.60S      | 6.44 psi | 6.44 psi | 10.20 psi | 11.08 psi | 11.08 psi | 75.00 psi | 0.15        | OK     |
| +1.20D+1.60S        | 4.12 psi | 4.12 psi | 6.38 psi  | 7.25 psi  | 7.25 psi  | 75.00 psi | 0.10        | OK     |
| +1.20D+L+0.50S      | 6.37 psi | 6.37 psi | 9.99 psi  | 11.08 psi | 11.08 psi | 75.00 psi | 0.15        | OK     |
| +0.90D              | 3.02 psi | 3.02 psi | 4.55 psi  | 5.44 psi  | 5.44 psi  | 75.00 psi | 0.07        | OK     |
| +1.20D+L+0.20S+E    | 6.88 psi | 6.88 psi | 6.44 psi  | 16.30 psi | 16.30 psi | 75.00 psi | 0.22        | OK     |
| +0.90D+E            | 3.54 psi | 3.54 psi | 1.05 psi  | 10.66 psi | 10.66 psi | 75.00 psi | 0.14        | OK     |

#### Two-Way "Punching" Shear

| Load Combination... | Vu        | Phi*Vn    | Vu / Phi*Vn | Status |
|---------------------|-----------|-----------|-------------|--------|
| +1.40D              | 23.93 psi | 150.00psi | 0.1596      | OK     |
| +1.20D+1.60L        | 39.38 psi | 150.00psi | 0.2625      | OK     |
| +1.20D+1.60L+0.50S  | 39.53 psi | 150.00psi | 0.2635      | OK     |
| +1.20D+L            | 32.31 psi | 150.00psi | 0.2154      | OK     |
| +1.20D              | 20.52 psi | 150.00psi | 0.1368      | OK     |
| +1.20D+L+1.60S      | 32.78 psi | 150.00psi | 0.2185      | OK     |
| +1.20D+1.60S        | 20.99 psi | 150.00psi | 0.1399      | OK     |
| +1.20D+L+0.50S      | 32.45 psi | 150.00psi | 0.2163      | OK     |
| +0.90D              | 15.39 psi | 150.00psi | 0.1026      | OK     |
| +1.20D+L+0.20S+E    | 35.02 psi | 150.00psi | 0.2334      | OK     |
| +0.90D+E            | 18.04 psi | 150.00psi | 0.1203      | OK     |

All units k

## General Footing

Project File: Hong Kao - Rev 1.ec6

LIC#: KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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### DESCRIPTION: Rev 1 - Foundation F6 - Spread Footing at Stair

#### Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : ASCE 7-16

#### General Information

##### Material Properties

|                                |   |             |
|--------------------------------|---|-------------|
| f'c : Concrete 28 day strength | = | 2.50 ksi    |
| fy : Rebar Yield               | = | 40.0 ksi    |
| Ec : Concrete Elastic Modulus  | = | 3,122.0 ksi |
| Concrete Density               | = | 145.0 pcf   |
| φ Values Flexure               | = | 0.90        |
| Shear                          | = | 0.750       |

##### Soil Design Values

|                                       |   |           |
|---------------------------------------|---|-----------|
| Allowable Soil Bearing                | = | 2.0 ksf   |
| Soil Density                          | = | 110.0 pcf |
| Increase Bearing By Footing Weight    | = | Yes       |
| Soil Passive Resistance (for Sliding) | = | 350.0 pcf |
| Soil/Concrete Friction Coeff.         | = | 0.350     |

##### Increases based on footing depth

|  |   |         |
|--|---|---------|
| Footing base depth below soil surface                              | = | 1.50 ft |
| Allow press. increase per foot of depth when footing base is below | = | ksf ft  |

##### Increases based on footing plan dimension

|   |   |        |
|---|---|--------|
| Allowable pressure increase per foot of depth when max. length or width is greater than | = | ksf ft |
|---|---|--------|

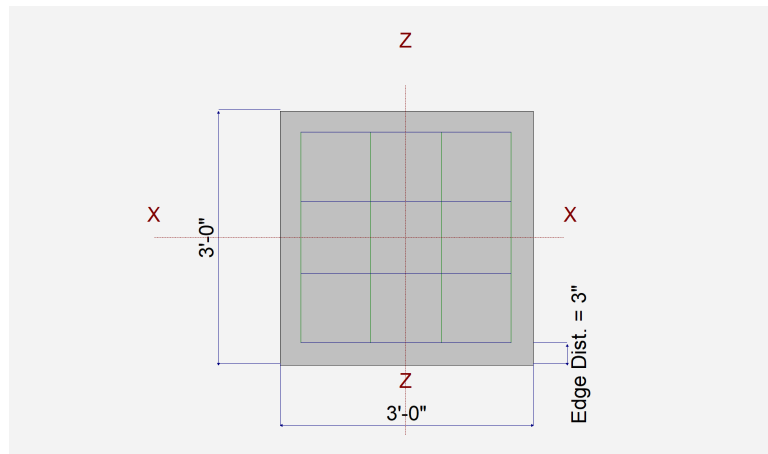
##### Analysis Settings

|  |   |         |
|--|---|---------|
| Min Steel % Bending Reinf.                 | = |         |
| Min Allow % Temp Reinf.                    | = | 0.00180 |
| Min. Overturning Safety Factor             | = | 1.0 : 1 |
| Min. Sliding Safety Factor                 | = | 1.0 : 1 |
| Add Ftg Wt for Soil Pressure               | : | Yes     |
| Use ftg wt for stability, moments & shears | : | Yes     |
| Add Pedestal Wt for Soil Pressure          | : | No      |
| Use Pedestal wt for stability, mom & shear | : | No      |

#### Dimensions

|                             |   |         |
|-----------------------------|---|---------|
| Width parallel to X-X Axis  | = | 3.0 ft  |
| Length parallel to Z-Z Axis | = | 3.0 ft  |
| Footing Thickness           | = | 10.0 in |

|  |   |        |
|--|---|--------|
| Pedestal dimensions...                                       | = |        |
| px : parallel to X-X Axis                                    | = | in     |
| pz : parallel to Z-Z Axis                                    | = | in     |
| Height   | = | in     |
| Rebar Centerline to Edge of Concrete... at Bottom of footing | = | 3.0 in |

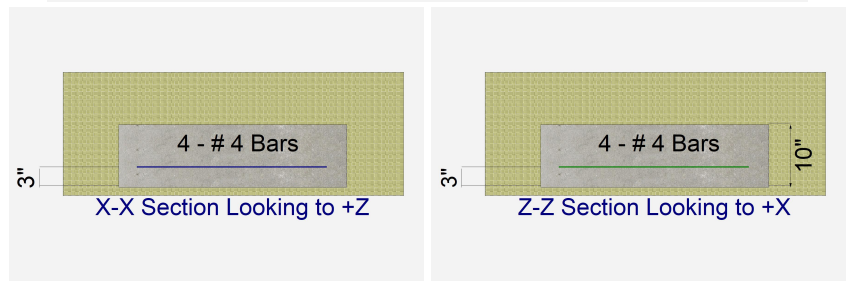


#### Reinforcing

|                           |   |     |
|---------------------------|---|-----|
| Bars parallel to X-X Axis | = |     |
| Number of Bars            | = | 4.0 |
| Reinforcing Bar Size      | = | # 4 |
| Bars parallel to Z-Z Axis | = |     |
| Number of Bars            | = | 4.0 |
| Reinforcing Bar Size      | = | # 4 |

##### Bandwidth Distribution Check (ACI 15.4.4.2)

|                                       |   |     |
|---------------------------------------|---|-----|
| Direction Requiring Closer Separation | = | n/a |
| # Bars required within zone           | = | n/a |
| # Bars required on each side of zone  | = | n/a |



#### Applied Loads

|                 | D | Lr    | L | S     | W     | E | H    |
|-----------------|---|-------|---|-------|-------|---|------|
| P : Column Load | = | 1.650 |   | 3.960 | 1.980 |   | k    |
| OB : Overburden | = |       |   |       |       |   | ksf  |
| M-xx            | = |       |   |       |       |   | k-ft |
| M-zz            | = |       |   |       |       |   | k-ft |
| V-x             | = |       |   |       |       |   | k    |
| V-z             | = |       |   |       |       |   | k    |

**General Footing**

**DESCRIPTION: Rev 1 - Foundation F6 - Spread Footing at Stair**

**DESIGN SUMMARY**

**Design OK**

|      | Min. Ratio | Item             | Applied       | Capacity      | Governing Load Combination      |
|------|------------|------------------|---------------|---------------|---------------------------------|
| PASS | 0.4114     | Soil Bearing     | 0.8725 ksf    | 2.121 ksf     | +D+0.750L+0.750S about Z-Z axis |
| PASS | n/a        | Overturing - X-X | 0.0 k-ft      | 0.0 k-ft      | No Overturing                   |
| PASS | n/a        | Overturing - Z-Z | 0.0 k-ft      | 0.0 k-ft      | No Overturing                   |
| PASS | n/a        | Sliding - X-X    | 0.0 k         | 0.0 k         | No Sliding                      |
| PASS | n/a        | Sliding - Z-Z    | 0.0 k         | 0.0 k         | No Sliding                      |
| PASS | n/a        | Uplift           | 0.0 k         | 0.0 k         | No Uplift                       |
| PASS | 0.2141     | Z Flexure (+X)   | 1.163 k-ft/ft | 5.433 k-ft/ft | +1.20D+1.60L+0.50S              |
| PASS | 0.2141     | Z Flexure (-X)   | 1.163 k-ft/ft | 5.433 k-ft/ft | +1.20D+1.60L+0.50S              |
| PASS | 0.2141     | X Flexure (+Z)   | 1.163 k-ft/ft | 5.433 k-ft/ft | +1.20D+1.60L+0.50S              |
| PASS | 0.2141     | X Flexure (-Z)   | 1.163 k-ft/ft | 5.433 k-ft/ft | +1.20D+1.60L+0.50S              |
| PASS | 0.1526     | 1-way Shear (+X) | 11.448 psi    | 75.0 psi      | +1.20D+1.60L+0.50S              |
| PASS | 0.1526     | 1-way Shear (-X) | 11.448 psi    | 75.0 psi      | +1.20D+1.60L+0.50S              |
| PASS | 0.1526     | 1-way Shear (+Z) | 11.448 psi    | 75.0 psi      | +1.20D+1.60L+0.50S              |
| PASS | 0.1526     | 1-way Shear (-Z) | 11.448 psi    | 75.0 psi      | +1.20D+1.60L+0.50S              |
| PASS | 0.3039     | 2-way Punching   | 45.580 psi    | 150.0 psi     | +1.20D+1.60L+0.50S              |

**Detailed Results**

**Soil Bearing**

| Rotation Axis & Load Combination... | Gross Allowable | Xecc | Zecc (in) | Actual Soil Bearing Stress @ Location |         |          |           | Actual / Allow Ratio |
|-------------------------------------|-----------------|------|-----------|---------------------------------------|---------|----------|-----------|----------------------|
|                                     |                 |      |           | Bottom, -Z                            | Top, +Z | Left, -X | Right, +X |                      |
| X-X, D Only                         | 2.121           | n/a  | 0.0       | 0.3775                                | 0.3775  | n/a      | n/a       | 0.178                |
| X-X, +D+L                           | 2.121           | n/a  | 0.0       | 0.8175                                | 0.8175  | n/a      | n/a       | 0.386                |
| X-X, +D+S                           | 2.121           | n/a  | 0.0       | 0.5975                                | 0.5975  | n/a      | n/a       | 0.282                |
| X-X, +D+0.750L                      | 2.121           | n/a  | 0.0       | 0.7075                                | 0.7075  | n/a      | n/a       | 0.334                |
| X-X, +D+0.750L+0.750S               | 2.121           | n/a  | 0.0       | 0.8725                                | 0.8725  | n/a      | n/a       | 0.411                |
| X-X, +0.60D                         | 2.121           | n/a  | 0.0       | 0.2265                                | 0.2265  | n/a      | n/a       | 0.107                |
| Z-Z, D Only                         | 2.121           | 0.0  | n/a       | n/a                                   | n/a     | 0.3775   | 0.3775    | 0.178                |
| Z-Z, +D+L                           | 2.121           | 0.0  | n/a       | n/a                                   | n/a     | 0.8175   | 0.8175    | 0.386                |
| Z-Z, +D+S                           | 2.121           | 0.0  | n/a       | n/a                                   | n/a     | 0.5975   | 0.5975    | 0.282                |
| Z-Z, +D+0.750L                      | 2.121           | 0.0  | n/a       | n/a                                   | n/a     | 0.7075   | 0.7075    | 0.334                |
| Z-Z, +D+0.750L+0.750S               | 2.121           | 0.0  | n/a       | n/a                                   | n/a     | 0.8725   | 0.8725    | 0.411                |
| Z-Z, +0.60D                         | 2.121           | 0.0  | n/a       | n/a                                   | n/a     | 0.2265   | 0.2265    | 0.107                |

**Overturing Stability**

| Rotation Axis & Load Combination... | Overturing Moment | Resisting Moment | Stability Ratio | Status |
|-------------------------------------|-------------------|------------------|-----------------|--------|
| Footing Has NO Overturing           |                   |                  |                 |        |

All units k

**Sliding Stability**

| Force Application Axis Load Combination... | Sliding Force | Resisting Force | Stability Ratio | Status |
|--|---------------|-----------------|-----------------|--------|
| Footing Has NO Sliding                     |               |                 |                 |        |

**Footing Flexure**

| Flexure Axis & Load Combination | Mu k-ft | Side | Tension Surface | As Req'd in^2 | Gvrn. As in^2 | Actual As in^2 | Phi*Mn k-ft | Status |
|---------------------------------|---------|------|-----------------|---------------|---------------|----------------|-------------|--------|
| X-X, +1.40D                     | 0.2888  | +Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |
| X-X, +1.40D                     | 0.2888  | -Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |
| X-X, +1.20D+1.60L               | 1.040   | +Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |
| X-X, +1.20D+1.60L               | 1.040   | -Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |
| X-X, +1.20D+1.60L+0.50S         | 1.163   | +Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |
| X-X, +1.20D+1.60L+0.50S         | 1.163   | -Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |
| X-X, +1.20D+L                   | 0.7425  | +Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |
| X-X, +1.20D+L                   | 0.7425  | -Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |
| X-X, +1.20D                     | 0.2475  | +Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |
| X-X, +1.20D                     | 0.2475  | -Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |
| X-X, +1.20D+L+1.60S             | 1.139   | +Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |
| X-X, +1.20D+L+1.60S             | 1.139   | -Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |
| X-X, +1.20D+1.60S               | 0.6435  | +Z   | Bottom          | 0.2160        | AsMin         | 0.2667         | 5.433       | OK     |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**General Footing**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION: Rev 1 - Foundation F6 - Spread Footing at Stair**

**Footing Flexure**

| Flexure Axis & Load Combination | Mu<br>k-ft | Side | Tension<br>Surface | As Req'd<br>in^2 | Gvrn. As<br>in^2 | Actual As<br>in^2 | Phi*Mn<br>k-ft | Status |
|---------------------------------|------------|------|--------------------|------------------|------------------|-------------------|----------------|--------|
| X-X, +1.20D+1.60S               | 0.6435     | -Z   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| X-X, +1.20D+L+0.50S             | 0.8663     | +Z   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| X-X, +1.20D+L+0.50S             | 0.8663     | -Z   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| X-X, +0.90D                     | 0.1856     | +Z   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| X-X, +0.90D                     | 0.1856     | -Z   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| X-X, +1.20D+L+0.20S             | 0.7920     | +Z   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| X-X, +1.20D+L+0.20S             | 0.7920     | -Z   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.40D                     | 0.2888     | -X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.40D                     | 0.2888     | +X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+1.60L               | 1.040      | -X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+1.60L               | 1.040      | +X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+1.60L+0.50S         | 1.163      | -X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+1.60L+0.50S         | 1.163      | +X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+L                   | 0.7425     | -X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+L                   | 0.7425     | +X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D                     | 0.2475     | -X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D                     | 0.2475     | +X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+L+1.60S             | 1.139      | -X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+L+1.60S             | 1.139      | +X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+1.60S               | 0.6435     | -X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+1.60S               | 0.6435     | +X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+L+0.50S             | 0.8663     | -X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+L+0.50S             | 0.8663     | +X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +0.90D                     | 0.1856     | -X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +0.90D                     | 0.1856     | +X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+L+0.20S             | 0.7920     | -X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |
| Z-Z, +1.20D+L+0.20S             | 0.7920     | +X   | Bottom             | 0.2160           | AsMin            | 0.2667            | 5.433          | OK     |

**One Way Shear**

| Load Combination... | Vu @ -X   | Vu @ +X   | Vu @ -Z   | Vu @ +Z   | Vu:Max    | Phi Vn    | Vu / Phi*Vn | Status |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|--------|
| +1.40D              | 2.84 psi  | 2.84 psi  | 2.84 psi  | 2.84 psi  | 2.84 psi  | 75.00 psi | 0.04        | OK     |
| +1.20D+1.60L        | 10.23 psi | 10.23 psi | 10.23 psi | 10.23 psi | 10.23 psi | 75.00 psi | 0.14        | OK     |
| +1.20D+1.60L+0.50S  | 11.45 psi | 11.45 psi | 11.45 psi | 11.45 psi | 11.45 psi | 75.00 psi | 0.15        | OK     |
| +1.20D+L            | 7.31 psi  | 7.31 psi  | 7.31 psi  | 7.31 psi  | 7.31 psi  | 75.00 psi | 0.10        | OK     |
| +1.20D              | 2.44 psi  | 2.44 psi  | 2.44 psi  | 2.44 psi  | 2.44 psi  | 75.00 psi | 0.03        | OK     |
| +1.20D+L+1.60S      | 11.20 psi | 11.20 psi | 11.20 psi | 11.20 psi | 11.20 psi | 75.00 psi | 0.15        | OK     |
| +1.20D+1.60S        | 6.33 psi  | 6.33 psi  | 6.33 psi  | 6.33 psi  | 6.33 psi  | 75.00 psi | 0.08        | OK     |
| +1.20D+L+0.50S      | 8.53 psi  | 8.53 psi  | 8.53 psi  | 8.53 psi  | 8.53 psi  | 75.00 psi | 0.11        | OK     |
| +0.90D              | 1.83 psi  | 1.83 psi  | 1.83 psi  | 1.83 psi  | 1.83 psi  | 75.00 psi | 0.02        | OK     |
| +1.20D+L+0.20S      | 7.79 psi  | 7.79 psi  | 7.79 psi  | 7.79 psi  | 7.79 psi  | 75.00 psi | 0.10        | OK     |

All units k

**Two-Way "Punching" Shear**

| Load Combination... | Vu        | Phi*Vn    | Vu / Phi*Vn | Status |
|---------------------|-----------|-----------|-------------|--------|
| +1.40D              | 11.31 psi | 150.00psi | 0.07543     | OK     |
| +1.20D+1.60L        | 40.73 psi | 150.00psi | 0.2715      | OK     |
| +1.20D+1.60L+0.50S  | 45.58 psi | 150.00psi | 0.3039      | OK     |
| +1.20D+L            | 29.09 psi | 150.00psi | 0.194       | OK     |
| +1.20D              | 9.70 psi  | 150.00psi | 0.06465     | OK     |
| +1.20D+L+1.60S      | 44.61 psi | 150.00psi | 0.2974      | OK     |
| +1.20D+1.60S        | 25.22 psi | 150.00psi | 0.1681      | OK     |
| +1.20D+L+0.50S      | 33.94 psi | 150.00psi | 0.2263      | OK     |
| +0.90D              | 7.27 psi  | 150.00psi | 0.04849     | OK     |
| +1.20D+L+0.20S      | 31.03 psi | 150.00psi | 0.2069      | OK     |

## General Footing

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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### DESCRIPTION: Rev 1 - Foundation F7 - Spread Footing at Office

#### Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : ASCE 7-16

#### General Information

##### Material Properties

|                                |   |             |
|--------------------------------|---|-------------|
| f'c : Concrete 28 day strength | = | 2.50 ksi    |
| fy : Rebar Yield               | = | 40.0 ksi    |
| Ec : Concrete Elastic Modulus  | = | 3,122.0 ksi |
| Concrete Density               | = | 145.0 pcf   |
| φ Values Flexure               | = | 0.90        |
| Shear                          | = | 0.750       |

##### Soil Design Values

|                                       |   |           |
|---------------------------------------|---|-----------|
| Allowable Soil Bearing                | = | 2.0 ksf   |
| Soil Density                          | = | 110.0 pcf |
| Increase Bearing By Footing Weight    | = | Yes       |
| Soil Passive Resistance (for Sliding) | = | 350.0 pcf |
| Soil/Concrete Friction Coeff.         | = | 0.350     |

##### Analysis Settings

|  |   |         |
|--|---|---------|
| Min Steel % Bending Reinf.                 | = |         |
| Min Allow % Temp Reinf.                    | = | 0.00180 |
| Min. Overturning Safety Factor             | = | 1.0 : 1 |
| Min. Sliding Safety Factor                 | = | 1.0 : 1 |
| Add Ftg Wt for Soil Pressure               | : | Yes     |
| Use ftg wt for stability, moments & shears | : | Yes     |
| Add Pedestal Wt for Soil Pressure          | : | No      |
| Use Pedestal wt for stability, mom & shear | : | No      |

##### Increases based on footing Depth

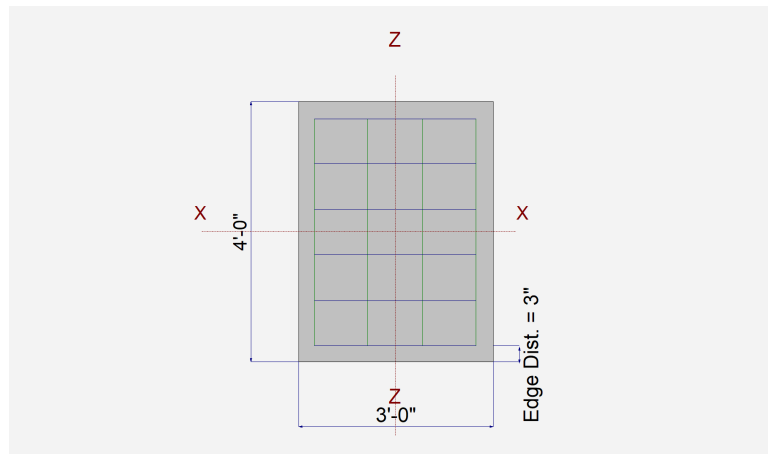
|  |   |         |
|--|---|---------|
| Footing base depth below soil surface                              | = | 1.50 ft |
| Allow press. increase per foot of depth when footing base is below | = | ksf ft  |

##### Increases based on footing plan dimension

|   |   |        |
|---|---|--------|
| Allowable pressure increase per foot of depth when max. length or width is greater than | = | ksf ft |
|---|---|--------|

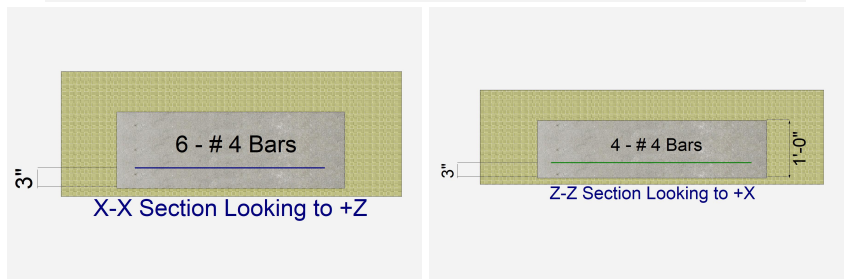
#### Dimensions

|   |   |         |
|---|---|---------|
| Width parallel to X-X Axis  | = | 3.0 ft  |
| Length parallel to Z-Z Axis                                       | = | 4.0 ft  |
| Footing Thickness   | = | 12.0 in |
| Load location offset from footing center... ez : Prll to Z-Z Axis | = | 4 in    |
|   | = | in      |
| Pedestal dimensions... px : parallel to X-X Axis                  | = | in      |
| pz : parallel to Z-Z Axis   | = | in      |
| Height  | = | in      |
| Rebar Centerline to Edge of Concrete... at Bottom of footing      | = | 3.0 in  |



#### Reinforcing

|  |                     |        |
|--|---------------------|--------|
| Bars parallel to X-X Axis                          | =                   |        |
| Number of Bars                                     | =                   | 6.0    |
| Reinforcing Bar Size                               | =                   | # 4    |
| Bars parallel to Z-Z Axis                          | =                   |        |
| Number of Bars                                     | =                   | 4.0    |
| Reinforcing Bar Size                               | =                   | # 4    |
| <b>Bandwidth Distribution Check (ACI 15.4.4.2)</b> |                     |        |
| Direction Requiring Closer Separation              |                     |        |
|  | Bars along X-X Axis |        |
| # Bars required within zone                        |                     | 85.7 % |
| # Bars required on each side of zone               |                     | 14.3 % |



#### Applied Loads

|                 | D | Lr    | L | S    | W    | E | H    |
|-----------------|---|-------|---|------|------|---|------|
| P : Column Load | = | 10.40 |   | 2.10 | 1.60 |   | k    |
| OB : Overburden | = |       |   |      |      |   | ksf  |
| M-xx            | = |       |   |      |      |   | k-ft |
| M-zz            | = |       |   |      |      |   | k-ft |
| V-x             | = |       |   |      |      |   | k    |
| V-z             | = |       |   |      |      |   | k    |

**General Footing**

**DESCRIPTION: Rev 1 - Foundation F7 - Spread Footing at Office**

**DESIGN SUMMARY**

**Design OK**

|      | Min. Ratio | Item              | Applied       | Capacity      | Governing Load Combination      |
|------|------------|-------------------|---------------|---------------|---------------------------------|
| PASS | 0.8583     | Soil Bearing      | 1.841 ksf     | 2.145 ksf     | +D+0.750L+0.750S about X-X axis |
| PASS | n/a        | Overturning - X-X | 0.0 k-ft      | 0.0 k-ft      | No Overturning                  |
| PASS | n/a        | Overturning - Z-Z | 0.0 k-ft      | 0.0 k-ft      | No Overturning                  |
| PASS | n/a        | Sliding - X-X     | 0.0 k         | 0.0 k         | No Sliding                      |
| PASS | n/a        | Sliding - Z-Z     | 0.0 k         | 0.0 k         | No Sliding                      |
| PASS | n/a        | Uplift            | 0.0 k         | 0.0 k         | No Uplift                       |
| PASS | 0.2037     | Z Flexure (+X)    | 1.607 k-ft/ft | 7.888 k-ft/ft | +1.20D+L+1.60S                  |
| PASS | 0.2037     | Z Flexure (-X)    | 1.607 k-ft/ft | 7.888 k-ft/ft | +1.20D+L+1.60S                  |
| PASS | 0.3839     | X Flexure (+Z)    | 2.70 k-ft/ft  | 7.033 k-ft/ft | +1.20D+L+1.60S                  |
| PASS | 0.3839     | X Flexure (-Z)    | 2.70 k-ft/ft  | 7.033 k-ft/ft | +1.20D+L+1.60S                  |
| PASS | 0.1323     | 1-way Shear (+X)  | 9.919 psi     | 75.0 psi      | +1.20D+L+1.60S                  |
| PASS | 0.1323     | 1-way Shear (-X)  | 9.919 psi     | 75.0 psi      | +1.20D+L+1.60S                  |
| PASS | 0.2247     | 1-way Shear (+Z)  | 16.852 psi    | 75.0 psi      | +1.20D+L+1.60S                  |
| PASS | 0.1975     | 1-way Shear (-Z)  | 14.812 psi    | 75.0 psi      | +1.20D+L+1.60S                  |
| PASS | 0.3359     | 2-way Punching    | 50.388 psi    | 150.0 psi     | +1.20D+L+1.60S                  |

**Detailed Results**

**Soil Bearing**

| Rotation Axis & Load Combination... | Gross Allowable | Xecc      |       | Actual Soil Bearing Stress @ Location |         |          |           | Actual / Allow Ratio |
|-------------------------------------|-----------------|-----------|-------|---------------------------------------|---------|----------|-----------|----------------------|
|                                     |                 | Zecc (in) |       | Bottom, -Z                            | Top, +Z | Left, -X | Right, +X |                      |
| X-X, D Only                         | 2.145           | n/a       | 3.250 | 0.6377                                | 1.496   | n/a      | n/a       | 0.697                |
| X-X, +D+L                           | 2.145           | n/a       | 3.356 | 0.7260                                | 1.757   | n/a      | n/a       | 0.819                |
| X-X, +D+S                           | 2.145           | n/a       | 3.333 | 0.7050                                | 1.695   | n/a      | n/a       | 0.790                |
| X-X, +D+0.750L                      | 2.145           | n/a       | 3.332 | 0.7039                                | 1.692   | n/a      | n/a       | 0.789                |
| X-X, +D+0.750L+0.750S               | 2.145           | n/a       | 3.384 | 0.7544                                | 1.841   | n/a      | n/a       | 0.858                |
| X-X, +0.60D                         | 2.145           | n/a       | 3.250 | 0.3826                                | 0.8974  | n/a      | n/a       | 0.418                |
| Z-Z, D Only                         | 2.145           | 0.0       | n/a   | n/a                                   | n/a     | 1.067    | 1.067     | 0.497                |
| Z-Z, +D+L                           | 2.145           | 0.0       | n/a   | n/a                                   | n/a     | 1.242    | 1.242     | 0.579                |
| Z-Z, +D+S                           | 2.145           | 0.0       | n/a   | n/a                                   | n/a     | 1.20     | 1.20      | 0.559                |
| Z-Z, +D+0.750L                      | 2.145           | 0.0       | n/a   | n/a                                   | n/a     | 1.198    | 1.198     | 0.559                |
| Z-Z, +D+0.750L+0.750S               | 2.145           | 0.0       | n/a   | n/a                                   | n/a     | 1.298    | 1.298     | 0.605                |
| Z-Z, +0.60D                         | 2.145           | 0.0       | n/a   | n/a                                   | n/a     | 0.640    | 0.640     | 0.298                |

**Overturning Stability**

| Rotation Axis & Load Combination... | Overturning Moment | Resisting Moment | Stability Ratio | Status |
|-------------------------------------|--------------------|------------------|-----------------|--------|
| Footing Has NO Overturning          |                    |                  |                 |        |

All units k

**Sliding Stability**

| Force Application Axis & Load Combination... | Sliding Force | Resisting Force | Stability Ratio | Status |
|--|---------------|-----------------|-----------------|--------|
| Footing Has NO Sliding                       |               |                 |                 |        |

**Footing Flexure**

| Flexure Axis & Load Combination | Mu k-ft | Side | Tension Surface | As Req'd in^2 | Gvrn. As in^2 | Actual As in^2 | Phi*Mn k-ft | Status |
|---------------------------------|---------|------|-----------------|---------------|---------------|----------------|-------------|--------|
| X-X, +1.40D                     | 2.294   | +Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |
| X-X, +1.40D                     | 2.294   | -Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |
| X-X, +1.20D+1.60L               | 2.495   | +Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |
| X-X, +1.20D+1.60L               | 2.495   | -Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |
| X-X, +1.20D+1.60L+0.50S         | 2.621   | +Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |
| X-X, +1.20D+1.60L+0.50S         | 2.621   | -Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |
| X-X, +1.20D+L                   | 2.297   | +Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |
| X-X, +1.20D+L                   | 2.297   | -Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |
| X-X, +1.20D                     | 1.966   | +Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |
| X-X, +1.20D                     | 1.966   | -Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |
| X-X, +1.20D+L+1.60S             | 2.70    | +Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |
| X-X, +1.20D+L+1.60S             | 2.70    | -Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |
| X-X, +1.20D+1.60S               | 2.369   | +Z   | Bottom          | 0.2592        | AsMin         | 0.2667         | 7.033       | OK     |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**General Footing**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION: Rev 1 - Foundation F7 - Spread Footing at Office**

**Footing Flexure**

| Flexure Axis & Load Combination | Mu<br>k-ft | Side | Tension<br>Surface | As Req'd<br>in^2 | Gvrn. As<br>in^2 | Actual As<br>in^2 | Phi*Mn<br>k-ft | Status |
|---------------------------------|------------|------|--------------------|------------------|------------------|-------------------|----------------|--------|
| X-X, +1.20D+1.60S               | 2.369      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+L+0.50S             | 2.423      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+L+0.50S             | 2.423      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +0.90D                     | 1.474      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +0.90D                     | 1.475      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+L+0.20S             | 2.347      | +Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| X-X, +1.20D+L+0.20S             | 2.347      | -Z   | Bottom             | 0.2592           | AsMin            | 0.2667            | 7.033          | OK     |
| Z-Z, +1.40D                     | 1.365      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.40D                     | 1.365      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L               | 1.485      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L               | 1.485      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L+0.50S         | 1.560      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60L+0.50S         | 1.560      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L                   | 1.367      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L                   | 1.367      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D                     | 1.170      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D                     | 1.170      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+1.60S             | 1.607      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+1.60S             | 1.607      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60S               | 1.410      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+1.60S               | 1.410      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.50S             | 1.442      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.50S             | 1.442      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +0.90D                     | 0.8775     | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +0.90D                     | 0.8775     | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.20S             | 1.397      | -X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |
| Z-Z, +1.20D+L+0.20S             | 1.397      | +X   | Bottom             | 0.2592           | AsMin            | 0.30              | 7.888          | OK     |

**One Way Shear**

| Load Combination... | Vu @ -X  | Vu @ +X  | Vu @ -Z   | Vu @ +Z   | Vu:Max    | Phi Vn    | Vu / Phi*Vn | Status |
|---------------------|----------|----------|-----------|-----------|-----------|-----------|-------------|--------|
| +1.40D              | 8.43 psi | 8.43 psi | 12.58 psi | 14.32 psi | 14.32 psi | 75.00 psi | 0.19        | OK     |
| +1.20D+1.60L        | 9.17 psi | 9.17 psi | 13.69 psi | 15.57 psi | 15.57 psi | 75.00 psi | 0.21        | OK     |
| +1.20D+1.60L+0.50S  | 9.63 psi | 9.63 psi | 14.38 psi | 16.36 psi | 16.36 psi | 75.00 psi | 0.22        | OK     |
| +1.20D+L            | 8.44 psi | 8.44 psi | 12.60 psi | 14.34 psi | 14.34 psi | 75.00 psi | 0.19        | OK     |
| +1.20D              | 7.22 psi | 7.22 psi | 10.79 psi | 12.27 psi | 12.27 psi | 75.00 psi | 0.16        | OK     |
| +1.20D+L+1.60S      | 9.92 psi | 9.92 psi | 14.81 psi | 16.85 psi | 16.85 psi | 75.00 psi | 0.22        | OK     |
| +1.20D+1.60S        | 8.70 psi | 8.70 psi | 13.00 psi | 14.79 psi | 14.79 psi | 75.00 psi | 0.20        | OK     |
| +1.20D+L+0.50S      | 8.90 psi | 8.90 psi | 13.29 psi | 15.12 psi | 15.12 psi | 75.00 psi | 0.20        | OK     |
| +0.90D              | 5.42 psi | 5.42 psi | 8.09 psi  | 9.20 psi  | 9.20 psi  | 75.00 psi | 0.12        | OK     |
| +1.20D+L+0.20S      | 8.62 psi | 8.62 psi | 12.88 psi | 14.65 psi | 14.65 psi | 75.00 psi | 0.20        | OK     |

All units k

**Two-Way "Punching" Shear**

| Load Combination... | Vu        | Phi*Vn    | Vu / Phi*Vn | Status |
|---------------------|-----------|-----------|-------------|--------|
| +1.40D              | 42.80 psi | 150.00psi | 0.2854      | OK     |
| +1.20D+1.60L        | 46.57 psi | 150.00psi | 0.3104      | OK     |
| +1.20D+1.60L+0.50S  | 48.92 psi | 150.00psi | 0.3261      | OK     |
| +1.20D+L            | 42.86 psi | 150.00psi | 0.2858      | OK     |
| +1.20D              | 36.69 psi | 150.00psi | 0.2446      | OK     |
| +1.20D+L+1.60S      | 50.39 psi | 150.00psi | 0.3359      | OK     |
| +1.20D+1.60S        | 44.22 psi | 150.00psi | 0.2948      | OK     |
| +1.20D+L+0.50S      | 45.21 psi | 150.00psi | 0.3014      | OK     |
| +0.90D              | 27.52 psi | 150.00psi | 0.1834      | OK     |
| +1.20D+L+0.20S      | 43.80 psi | 150.00psi | 0.292       | OK     |



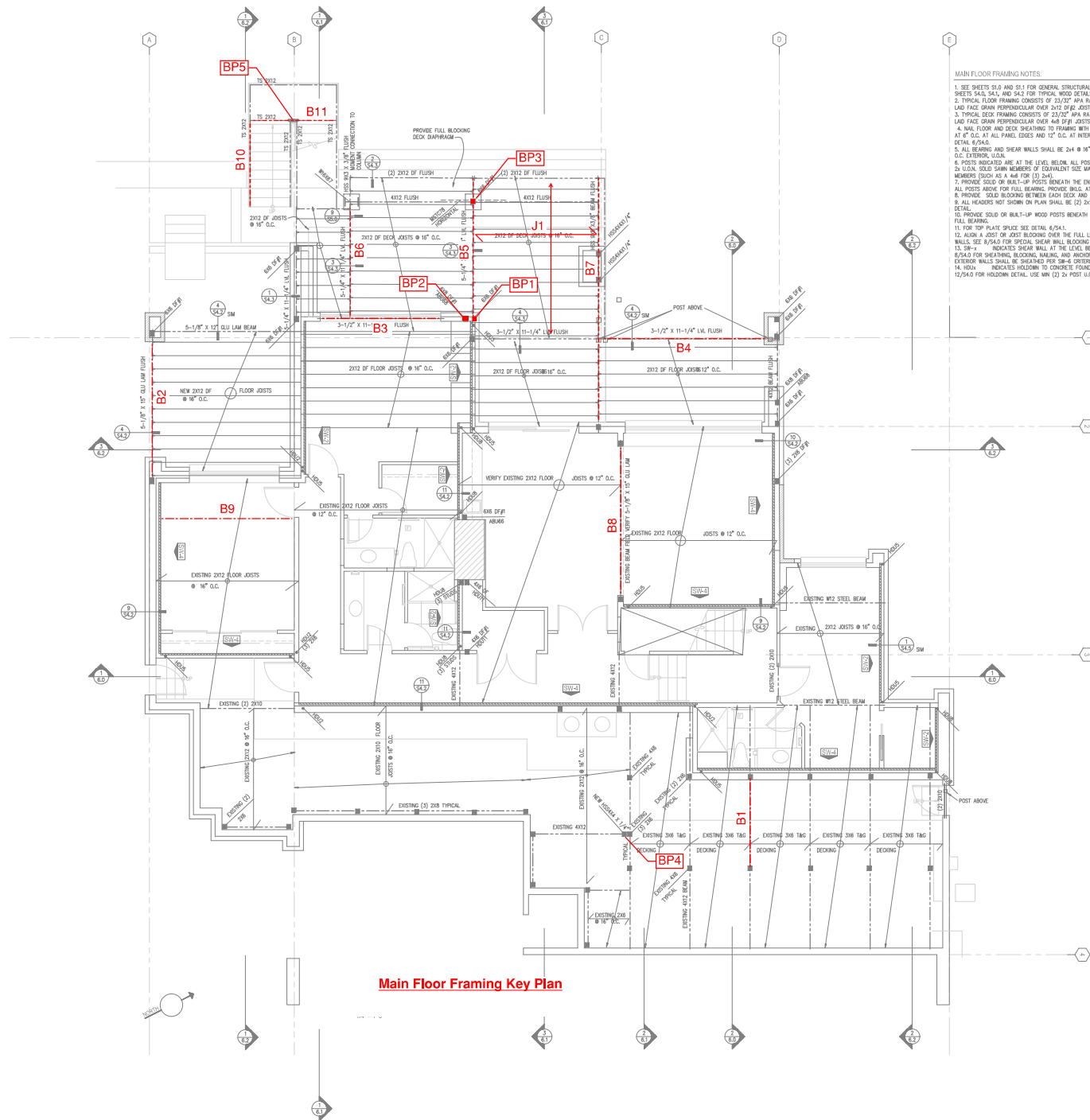


**HONG AND KAO RESIDENCE**

5425 W. Mercer Way  
Mercer Island, WA 98040

Quantum Job Number: 23127.01

# **GRAVITY DESIGN – MAIN HOUSE**



**Main Floor Framing Key Plan**

- MAIN FLOOR FRAMING NOTES:
- SEE SHEETS S1.0 AND S1.1 FOR GENERAL STRUCTURAL NOTES AND ABBREVIATIONS. SEE SHEETS S4.1, S4.2 AND S4.3 FOR TYPICAL WOOD DETAILS.
  - TYPICAL FLOOR FRAMING CONSISTS OF 2X12 SPS W/RA FATED SHEATHING (INDEX 48/24), LOAD FACE GRAN PERPENDICULAR OVER 2X12 DF JOISTS @ 16" O.C., U.O.N.
  - TYPICAL DECK FRAMING CONSISTS OF 2X12 SPS W/RA FATED SHEATHING (INDEX 48/24), LOAD FACE GRAN PERPENDICULAR OVER 4x8 DF JOISTS @ 16" O.C., U.O.N.
  - 2ND FLOOR AND DECK SHEATHING TO FRAMING WITH RA WALS (2X12" @ 2'5" LONG) AT 4" O.C. AT ALL PANEL EDGES AND 12" O.C. AT INTERMEDIATE FRAMING MEMBERS. SEE DETAIL 6/54.0.
  - ALL BEARING AND SHEAR WALLS SHALL BE 2x4 @ 16" O.C. INTERIOR AND 2x6 @ 16" O.C. EXTERIOR, U.O.N.
  - POSTS INDICATED ARE AT THE LEVEL BELOW. ALL POSTS NOT SPECIFIED SHALL BE (2) 2x4 U.O.N. SOLID SWAN MEMBERS OF EQUIVALENT SIZE W/IF BE SUBSTITUTED FOR MULTI-LIP MEMBERS (SUCH AS A 4x6 FOR (2) 2x4).
  - PROVIDE SOLID OR BUILT-UP POSTS BENEATH THE ENDS OF ALL FLOOR BEAMS AND ALL POSTS ABOVE FOR FULL BLOODING. PROVIDE B.L.G. AT JOISTS FOR DETAIL 7/54.1.
  - PROVIDE SOLID BLOODING BETWEEN EACH DECK AND FLOOR JOIST AT SUPPORTS.
  - ALL HEADERS NOT SHOWN ON PLAN SHALL BE (2) 2x4S. SEE 10/54.1 FOR HEADER DETAIL.
  - PROVIDE SOLID OR BUILT-UP WOOD POSTS BENEATH THE ENDS OF ALL BEAMS FOR FULL BLOODING.
  - FOR TOP PLATE SPRUCE SEE DETAIL 6/54.1.
  - ALSO A JOIST OR JOIST BLOODING OVER THE FULL LENGTH OF ALL BEARING/SHEAR WALLS. SEE 6/54.0 FOR SPECIAL SHEAR WALL BLOODING REQUIREMENTS.
  - 3/8" x 4" INDICATES SHEAR WALL AT THE LEVEL BELOW. SEE SHEAR WALL SCHEDULE 6/54.0 FOR BLOODING, BLOODING, MARKING, AND ANCHOR BOLT REQUIREMENTS.
  - EXTERIOR WALLS SHALL BE SHEATHED PER 5/8-6 CRITERIA, U.O.N.
  - 14' H.O.D. INDICATES HOLDOWN TO CONCRETE FOUNDATION WALLS OR FOOTINGS. SEE 12/54.0 FOR HOLDOWN DETAIL. USE MIN (2) 2x POST U.O.N.

No. Date Revision

**HONG AND KAO RESIDENCE**  
 5425 W. MERCER WAY  
 MERCER ISLAND, WA 98040

MAIN FLOOR  
 FRAMING PLAN

Sheet No. **S.2**  
 Project No. 2222  
 Date: 5/30/23

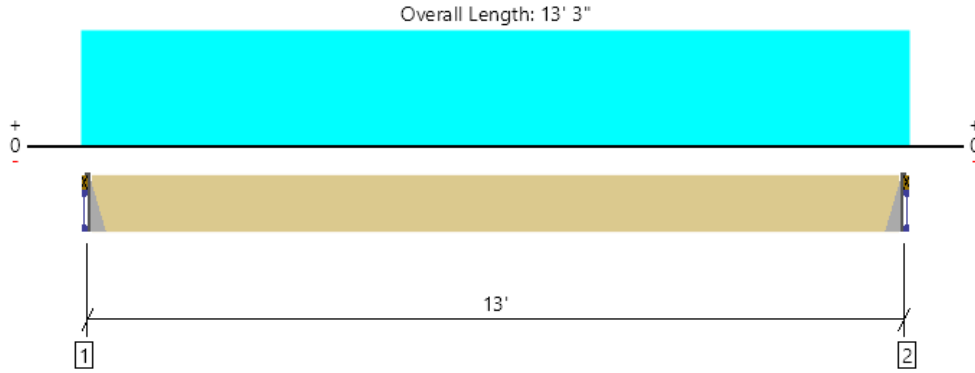
**CHESTMOREBUCK**  
 architecture  
 27100TH AVENUE, NE, SUITE 100  
 BELLEVUE, WA 98004  
 FAX: 425-678-8884  
 PHONE: 425-678-9897

| Lower Roof   |         |   |          |
|--|---------|---|----------|
| Member Name  | Results | Current Solution                                    | Comments |
| Rev 1 RB15 - Living Room Flush Beam, Grid 3        | Passed  | 1 piece(s) 3 1/8" x 12" 24F-V4 DF Glulam            |          |
| Rev 1 RB13 - Existing Entry Header, 12'-0"         | Passed  | 3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL     |          |
| Upper Floor  |         |   |          |
| Member Name  | Results | Current Solution                                    | Comments |
| Rev 1 UJ2 - Exercise Floor Joist, 12'-6"           | Passed  | 1 piece(s) 11 7/8" TJI® 110 @ 16" OC                |          |
| Rev 1 UJ3 - Shower Floor Joist, 6'-0"              | Passed  | 1 piece(s) 2 x 8 HF No.2 @ 16" OC                   |          |
| Rev 1 UJ5 - Master Floor Joist, 18'-0"             | Passed  | 1 piece(s) 2 x 12 HF No.2 @ 12" OC                  |          |
| Rev 1 UJ8 - Landing Floor Joist, 7'-0"             | Passed  | 1 piece(s) 2 x 6 HF No.2 @ 16" OC                   |          |
| Rev 1 UB1 - Garage Door Header, 9'-6"              | Passed  | 1 piece(s) 5 1/8" x 10 1/2" 24F-V4 DF Glulam        |          |
| Rev 1 UB3 - Flush Beam at Shower, 11'-9"           | Passed  | 1 piece(s) 1 3/4" x 11 7/8" 1.55E TimberStrand® LSL |          |
| Rev 1 UB4 - Garage Window Header, 9'-6"            | Passed  | 1 piece(s) 5 1/8" x 9" 24F-V4 DF Glulam             |          |
| Rev 1 UB5 - Beam over Pantry, 15'-0"               | Passed  | 1 piece(s) 3 1/8" x 18" 24F-V4 DF Glulam            |          |
| Rev 1 UB7 - Flush Header at Master Window, 17'-0"  | Passed  | 3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL     |          |
| Rev 1 UB7b - Flush Header at Master Window, 13'-0" | Passed  | 3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL     |          |
| Rev 1 UB13 - Flush Beam over Dining, 19'-4"        | Passed  | 1 piece(s) 5 1/8" x 22 1/2" 24F-V4 DF Glulam        |          |
| Rev 1 UB14 - Utility Room Header, 5'-6"            | Passed  | 2 piece(s) 2 x 10 HF No.2                           |          |
| Rev 1 UB15 - Flush Beam over Entry, 11'-6"         | Passed  | 1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL |          |
| Main Floor   |         |   |          |
| Member Name  | Results | Current Solution                                    | Comments |
| Rev 1 J1 - Deck Joist, 13'-0"                      | Passed  | 1 piece(s) 2 x 12 DF No.2 @ 16" OC                  |          |
| Rev 1 J2 - Floor Joist, 14'-0"                     | Passed  | 1 piece(s) 2 x 12 HF No.2 @ 16" OC                  |          |
| Rev 1 J3 - Floor Joist, 17'-0"                     | Passed  | 1 piece(s) 2 x 12 DF No.2 @ 16" OC                  |          |
| Rev 1 J4 - Floor Joist, 18'-0"                     | Passed  | 1 piece(s) 2 x 12 DF No.2 @ 12" OC                  |          |
| Rev 1 J5 - Entry Floor Joist, 12'-0"               | Passed  | 1 piece(s) 2 x 8 DF No.1 @ 16" OC                   |          |
| Rev 1 B2 - Office Flush Beam, Grid A               | Passed  | 1 piece(s) 5 1/8" x 15" 24F-V4 DF Glulam            |          |
| Rev 1 B8 - Family Room Flush Beam, Grid C          | Passed  | 1 piece(s) 5 1/8" x 15" 24F-V4 DF Glulam            |          |
| Rev 1 B9 - Office Flush Beam, Grid 2               | Passed  | 1 piece(s) 5 1/8" x 10 1/2" 24F-V4 DF Glulam        |          |
| Rev 1 P1 - Garage Header Post                      | Passed  | 1 piece(s) 6 x 6 DF No.1                            |          |
| Rev 1 P3 - Living Room Wall Post, Grid 1           | Passed  | 1 piece(s) 6 x 6 DF No.1                            |          |

|   |           |
|---|-----------|
| ForteWEB Software Operator<br>Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com | Job Notes |
|---|-----------|



Main Floor, Rev 1 J1 - Deck Joist, 13'-0"  
1 piece(s) 2 x 12 DF No.2 @ 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) | 711 @ 1' 1/2"     | 1406 (1.50") | Passed (51%)   | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 608 @ 1' 3/4"     | 2025         | Passed (30%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 2310 @ 6' 7 1/2"  | 2729         | Passed (85%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.181 @ 6' 7 1/2" | 0.325        | Passed (L/864) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.247 @ 6' 7 1/2" | 0.650        | Passed (L/632) | --   | 1.0 D + 1.0 L (All Spans)   |
| TJ-Pro™ 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.

| Supports                         | Bearing Length |                     |          | Loads to Supports (lbs) |            |          | Accessories           |
|----------------------------------|----------------|---------------------|----------|-------------------------|------------|----------|-----------------------|
|                                  | Total          | Available           | Required | Dead                    | Floor Live | Factored |                       |
| 1 - Hanger on Single 2X HF plate | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 194                     | 530        | 724      | See note <sup>1</sup> |
| 2 - Hanger on Single 2X HF plate | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 194                     | 530        | 724      | See note <sup>1</sup> |

- 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)    | 5' o/c            |          |
| Bottom Edge (Lu) | 13' o/c           |          |

- Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie |                     |             |               |                |                  |             |  |
|-------------------------------|---------------------|-------------|---------------|----------------|------------------|-------------|--|
| Support                       | Model               | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |  |
| 1 - Top Mount Hanger          | Connector not found | N/A         | N/A           | N/A            | N/A              |             |  |
| 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.

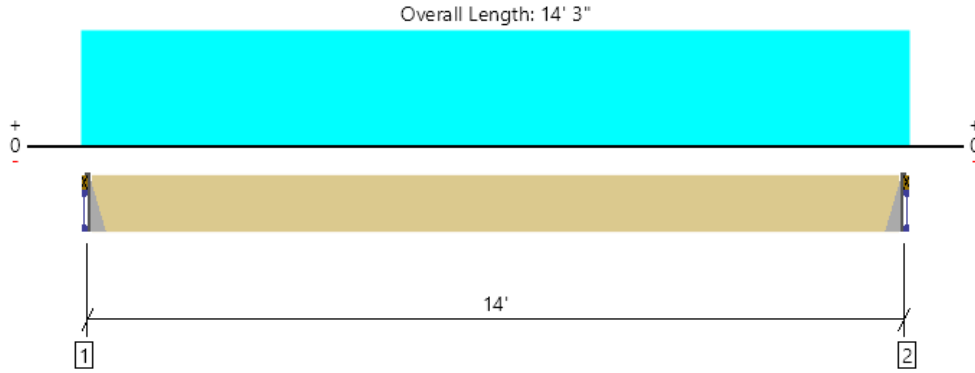
| Vertical Load     | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|-------------------|-----------------|---------|-------------|-------------------|----------|
| 1 - Uniform (PSF) | 0 to 13' 3"     | 16"     | 22.0        | 60.0              | Deck     |

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

| ForteWEB Software Operator  | Job Notes |
|---|-----------|
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Main Floor, Rev 1 J2 - Floor Joist, 14'-0"  
1 piece(s) 2 x 12 HF No.2 @ 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) | 513 @ 1' 1/2"     | 911 (1.50") | Passed (56%)   | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 445 @ 1' 3/4"     | 1688        | Passed (26%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 1797 @ 7' 1 1/2"  | 2577        | Passed (70%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.199 @ 7' 1 1/2" | 0.350       | Passed (L/843) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.274 @ 7' 1 1/2" | 0.700       | Passed (L/613) | --   | 1.0 D + 1.0 L (All Spans)   |
| TJ-Pro™ 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.

| Supports                         | Bearing Length |                     |          | Loads to Supports (lbs) |            |          | Accessories           |
|----------------------------------|----------------|---------------------|----------|-------------------------|------------|----------|-----------------------|
|                                  | Total          | Available           | Required | Dead                    | Floor Live | Factored |                       |
| 1 - Hanger on Single 2X HF plate | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 143                     | 380        | 523      | See note <sup>1</sup> |
| 2 - Hanger on Single 2X HF plate | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 143                     | 380        | 523      | See note <sup>1</sup> |

- 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)    | 6' o/c            |          |
| Bottom Edge (Lu) | 14' o/c           |          |

- Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie |                     |             |               |                |                  |             |  |
|-------------------------------|---------------------|-------------|---------------|----------------|------------------|-------------|--|
| Support                       | Model               | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |  |
| 1 - Top Mount Hanger          | Connector not found | N/A         | N/A           | N/A            | N/A              |             |  |
| 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.

| Vertical Load     | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|-------------------|-----------------|---------|-------------|-------------------|----------|
| 1 - Uniform (PSF) | 0 to 14' 3"     | 16"     | 15.0        | 40.0              | Floor    |

**Weyerhaeuser Notes**

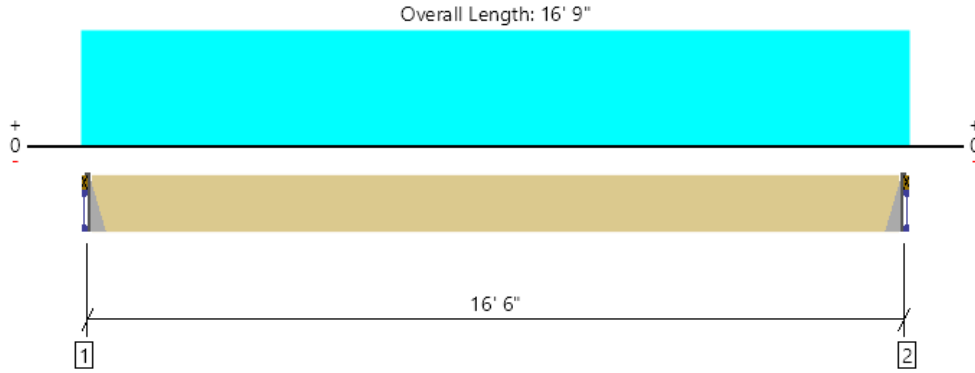
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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator  | Job Notes |
|---|-----------|
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Main Floor, Rev 1 J3 - Floor Joist, 17'-0"  
 1 piece(s) 2 x 12 DF No.2 @ 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) | 605 @ 1' 1/2"     | 1406 (1.50") | Passed (43%)   | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 536 @ 1' 3/4"     | 2025         | Passed (26%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 2496 @ 8' 4 1/2"  | 2729         | Passed (91%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.312 @ 8' 4 1/2" | 0.412        | Passed (L/634) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.429 @ 8' 4 1/2" | 0.825        | Passed (L/461) | --   | 1.0 D + 1.0 L (All Spans)   |
| TJ-Pro™ 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.

| Supports                         | Bearing Length |                     |          | Loads to Supports (lbs) |            |          | Accessories           |
|----------------------------------|----------------|---------------------|----------|-------------------------|------------|----------|-----------------------|
|                                  | Total          | Available           | Required | Dead                    | Floor Live | Factored |                       |
| 1 - Hanger on Single 2X HF plate | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 168                     | 447        | 614      | See note <sup>1</sup> |
| 2 - Hanger on Single 2X HF plate | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 168                     | 447        | 614      | See note <sup>1</sup> |

- 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)    | 3' 11" o/c        |          |
| Bottom Edge (Lu) | 16' 6" o/c        |          |

- Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie |                     |             |               |                |                  |             |  |
|-------------------------------|---------------------|-------------|---------------|----------------|------------------|-------------|--|
| Support                       | Model               | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |  |
| 1 - Top Mount Hanger          | Connector not found | N/A         | N/A           | N/A            | N/A              |             |  |
| 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.

| Vertical Load     | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|-------------------|-----------------|---------|-------------|-------------------|----------|
| 1 - Uniform (PSF) | 0 to 16' 9"     | 16"     | 15.0        | 40.0              | Floor    |

**Weyerhaeuser Notes**

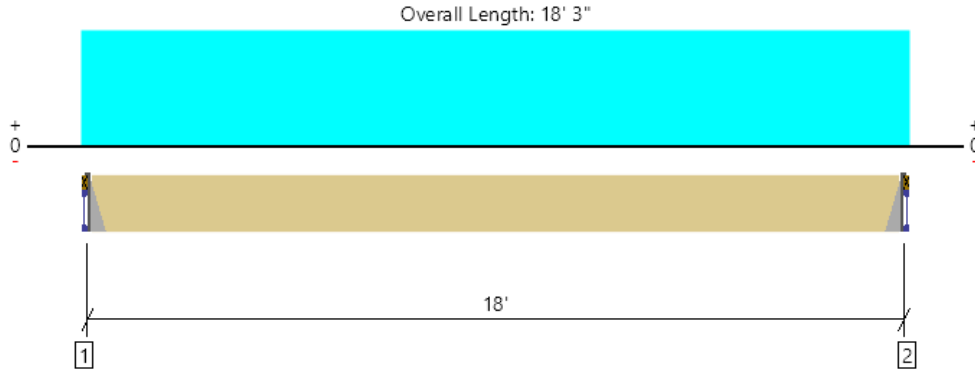
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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator  | Job Notes |
|---|-----------|
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Main Floor, Rev 1 J4 - Floor Joist, 18'-0"  
1 piece(s) 2 x 12 DF No.2 @ 12" 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) | 495 @ 1' 1/2"     | 1406 (1.50") | Passed (35%)   | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 443 @ 1' 3/4"     | 2025         | Passed (22%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 2228 @ 9' 1 1/2"  | 2729         | Passed (82%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.332 @ 9' 1 1/2" | 0.450        | Passed (L/651) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.456 @ 9' 1 1/2" | 0.900        | Passed (L/473) | --   | 1.0 D + 1.0 L (All Spans)   |
| TJ-Pro™ 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.

| Supports                         | Bearing Length |                     |          | Loads to Supports (lbs) |            |          | Accessories           |
|----------------------------------|----------------|---------------------|----------|-------------------------|------------|----------|-----------------------|
|                                  | Total          | Available           | Required | Dead                    | Floor Live | Factored |                       |
| 1 - Hanger on Single 2X HF plate | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 137                     | 365        | 502      | See note <sup>1</sup> |
| 2 - Hanger on Single 2X HF plate | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 137                     | 365        | 502      | See note <sup>1</sup> |

- 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)    | 5' 5" o/c         |          |
| Bottom Edge (Lu) | 18' o/c           |          |

- Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie |                     |             |               |                |                  |             |  |
|-------------------------------|---------------------|-------------|---------------|----------------|------------------|-------------|--|
| Support                       | Model               | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |  |
| 1 - Top Mount Hanger          | Connector not found | N/A         | N/A           | N/A            | N/A              |             |  |
| 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.

| Vertical Load     | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|-------------------|-----------------|---------|-------------|-------------------|----------|
| 1 - Uniform (PSF) | 0 to 18' 3"     | 12"     | 15.0        | 40.0              | Floor    |

**Weyerhaeuser Notes**

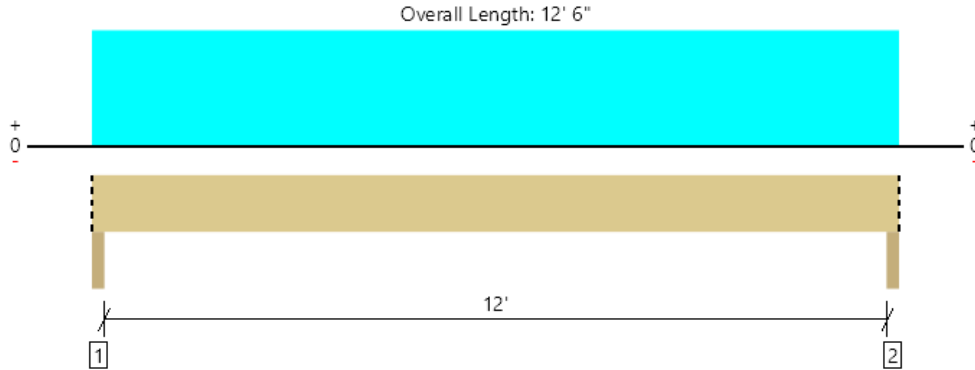
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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

|   |           |
|---|-----------|
| ForteWEB Software Operator  | Job Notes |
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Main Floor, Rev 1 J5 - Entry Floor Joist, 12'-0"  
1 piece(s) 2 x 8 DF No.1 @ 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) | 458 @ 2"          | 1823 (3.00") | Passed (25%)   | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 396 @ 10 1/4"     | 1305         | Passed (30%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 1357 @ 6' 3"      | 1511         | Passed (90%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.325 @ 6' 3"     | 0.406        | Passed (L/450) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.446 @ 6' 3"     | 0.608        | Passed (L/327) | --   | 1.0 D + 1.0 L (All Spans)   |
| TJ-Pro™ 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/360) 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.

| Supports      | Bearing Length |           |          | Loads to Supports (lbs) |            |          | Accessories |
|---------------|----------------|-----------|----------|-------------------------|------------|----------|-------------|
|               | Total          | Available | Required | Dead                    | Floor Live | Factored |             |
| 1 - Beam - HF | 3.00"          | 3.00"     | 1.50"    | 125                     | 333        | 458      | Blocking    |
| 2 - Beam - HF | 3.00"          | 3.00"     | 1.50"    | 125                     | 333        | 458      | 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)    | 5' 6" o/c         |          |
| Bottom Edge (Lu) | 12' 6" o/c        |          |

•Maximum allowable bracing intervals based on applied load.

| Vertical Load     | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|-------------------|-----------------|---------|-------------|-------------------|----------|
| 1 - Uniform (PSF) | 0 to 12' 6"     | 16"     | 15.0        | 40.0              | Floor    |

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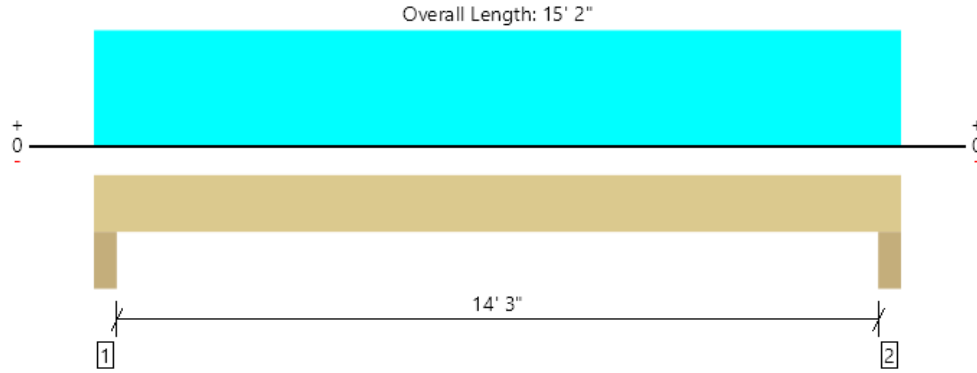
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

|   |           |
|---|-----------|
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Main Floor, Rev 1 B2 - Office Flush Beam, Grid A  
 1 piece(s) 5 1/8" x 15" 24F-V4 DF Glulam



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) | 8806 @ 4"         | 18322 (5.50") | Passed (48%)    | --   | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Shear (lbs)           | 6308 @ 1' 8 1/2"  | 13581         | Passed (46%)    | 1.00 | 1.0 D + 1.0 L (All Spans)           |
| Pos Moment (Ft-lbs)   | 28218 @ 7' 7"     | 38438         | Passed (73%)    | 1.00 | 1.0 D + 1.0 L (All Spans)           |
| Live Load Defl. (in)  | 0.141 @ 7' 7"     | 0.363         | Passed (L/999+) | --   | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Total Load Defl. (in) | 0.445 @ 7' 7"     | 0.725         | Passed (L/391)  | --   | 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).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 14' 6".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports        | Bearing Length |           |          | Loads to Supports (lbs) |            |      |          | Accessories |
|-----------------|----------------|-----------|----------|-------------------------|------------|------|----------|-------------|
|                 | Total          | Available | Required | Dead                    | Floor Live | Snow | Factored |             |
| 1 - Column - HF | 5.50"          | 5.50"     | 2.64"    | 6019                    | 2123       | 1593 | 8806     | None        |
| 2 - Column - HF | 5.50"          | 5.50"     | 2.64"    | 6019                    | 2123       | 1593 | 8806     | None        |

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 15' 2" o/c        |          |
| Bottom Edge (Lu) | 15' 2" o/c        |          |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads        | Location (Side)     | Tributary Width | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments       |
|-----------------------|---------------------|-----------------|-------------|-------------------|-------------|----------------|
| 0 - Self Weight (PLF) | 0 to 15' 2"         | N/A             | 18.7        | --                | --          |                |
| 1 - Uniform (PSF)     | 0 to 15' 2" (Front) | 7'              | 15.0        | 40.0              | -           | Floor          |
| 2 - Uniform (PSF)     | 0 to 15' 2" (Top)   | 7'              | 20.0        | -                 | 30.0        | Roof           |
| 3 - Uniform (PLF)     | 0 to 15' 2" (Top)   | N/A             | 530.0       | -                 | -           | Wall w/ veneer |

**Weyerhaeuser Notes**

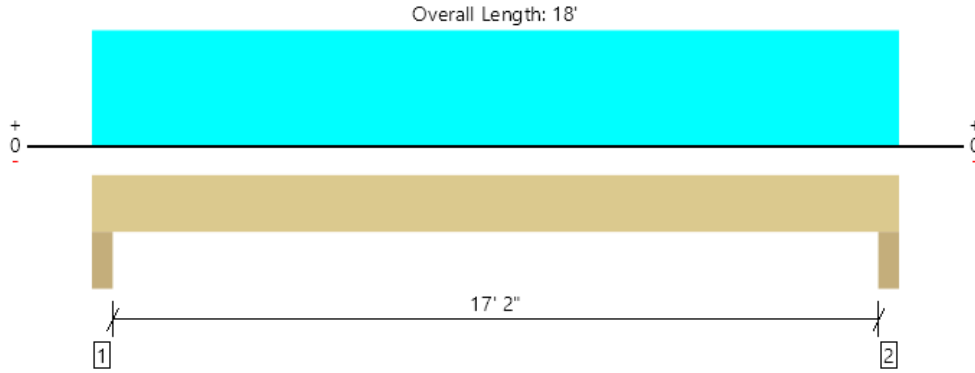
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|   |           |
|---|-----------|
| ForteWEB Software Operator  | Job Notes |
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Main Floor, Rev 1 B8 - Family Room Flush Beam, Grid C  
 1 piece(s) 5 1/8" x 15" 24F-V4 DF Glulam



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) | 7841 @ 3 1/2"     | 16656 (5.00") | Passed (47%)   | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 6389 @ 1' 8"      | 13581         | Passed (47%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Pos Moment (Ft-lbs)   | 33033 @ 9'        | 38299         | Passed (86%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.495 @ 9'        | 0.581         | Passed (L/422) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.695 @ 9'        | 0.871         | Passed (L/301) | --   | 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/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 17' 5".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports        | Bearing Length |           |          | Loads to Supports (lbs) |            |          | Accessories |
|-----------------|----------------|-----------|----------|-------------------------|------------|----------|-------------|
|                 | Total          | Available | Required | Dead                    | Floor Live | Factored |             |
| 1 - Column - HF | 5.00"          | 5.00"     | 2.35"    | 2261                    | 5580       | 7841     | None        |
| 2 - Column - HF | 5.00"          | 5.00"     | 2.35"    | 2261                    | 5580       | 7841     | None        |

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

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads        | Location (Side) | Tributary Width | Dead (0.90) | Floor Live (1.00) | Comments |
|-----------------------|-----------------|-----------------|-------------|-------------------|----------|
| 0 - Self Weight (PLF) | 0 to 18'        | N/A             | 18.7        | --                |          |
| 1 - Uniform (PSF)     | 0 to 18' (Top)  | 15' 6"          | 15.0        | 40.0              | Floor    |

**Weyerhaeuser Notes**

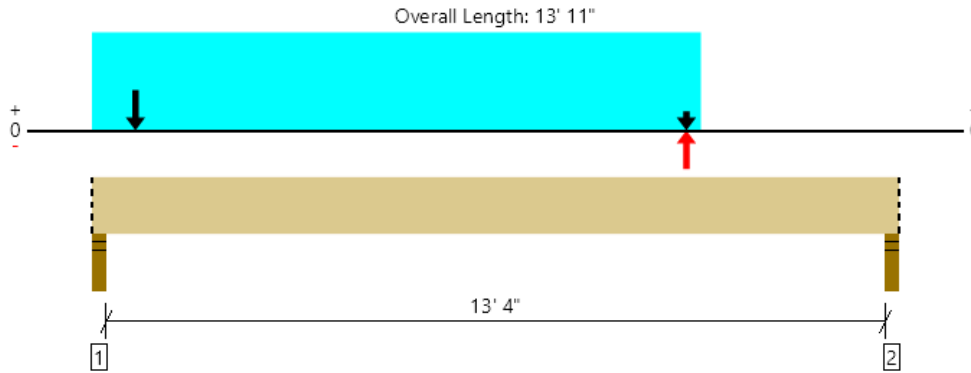
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|   |           |
|---|-----------|
| ForteWEB Software Operator  | Job Notes |
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Main Floor, Rev 1 B9 - Office Flush Beam, Grid 2  
 1 piece(s) 5 1/8" x 10 1/2" 24F-V4 DF Glulam



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) | 4965 @ 2"         | 7265 (3.50") | Passed (68%)     | --   | 1.0 D + 0.7 E (All Spans)   |
| Shear (lbs)           | 4437 @ 12' 9"     | 15211        | Passed (29%)     | 1.60 | 1.0 D - 0.7 E (All Spans)   |
| Pos Moment (Ft-lbs)   | 15492 @ 10' 3"    | 30135        | Passed (51%)     | 1.60 | 1.0 D - 0.7 E (All Spans)   |
| Neg Moment (Ft-lbs)   | -10376 @ 10' 3"   | 23229        | Passed (45%)     | 1.60 | 0.6 D + 0.7 E (All Spans)   |
| Live Load Defl. (in)  | 0.000 @ 0         | 0.453        | Passed (2L/999+) | --   | 1.0 D (All Spans)           |
| Total Load Defl. (in) | 0.135 @ 7' 13/16" | 0.679        | Passed (L/999+)  | --   | 1.0 D (All Spans)           |

System : Floor  
 Member Type : Flush Beam  
 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.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 12' 5 1/2".
- Critical negative moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 10' 8 11/16".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports           | Bearing Length |           |          | Loads to Supports (lbs) |            |            | Accessories |
|--------------------|----------------|-----------|----------|-------------------------|------------|------------|-------------|
|                    | Total          | Available | Required | Dead                    | Seismic    | Factored   |             |
| 1 - Stud wall - HF | 3.50"          | 3.50"     | 2.39"    | 1453                    | 5018/-5018 | 4965/-2641 | Blocking    |
| 2 - Stud wall - HF | 3.50"          | 3.50"     | 2.14"    | 940                     | 5018/-5018 | 4452/-2949 | 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)    | 13' 11" o/c       |          |
| Bottom Edge (Lu) | 13' 11" o/c       |          |

- Maximum allowable bracing intervals based on applied load.

| Vertical Loads        | Location (Side)   | Tributary Width | Dead (0.90) | Seismic (1.60) | Comments            |
|-----------------------|-------------------|-----------------|-------------|----------------|---------------------|
| 0 - Self Weight (PLF) | 0 to 13' 11"      | N/A             | 13.1        | --             |                     |
| 1 - Uniform (PLF)     | 0 to 10' 6" (Top) | N/A             | 100.0       | -              | Wall                |
| 2 - Point (lb)        | 9" (Top)          | N/A             | 580         | 7175           | Shear Wall Reaction |
| 3 - Point (lb)        | 10' 3" (Top)      | N/A             | 580         | -7175          | Shear Wall Reaction |

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

| ForteWEB Software Operator  | Job Notes |
|---|-----------|
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Main Floor, Rev 1 P1 - Garage Header Post  
1 piece(s) 6 x 6 DF No.1

Post Height: 8'



| Design Results      | Actual | Allowed | Result       | LDF  | Load: Combination       |
|---------------------|--------|---------|--------------|------|-------------------------|
| Slenderness         | 17     | 50      | Passed (35%) | --   | --                      |
| Compression (lbs)   | 12602  | 24796   | Passed (51%) | 1.00 | 1.0 D + 1.0 L           |
| Base Bearing (lbs)  | 12799  | 898425  | Passed (1%)  | --   | 1.0 D + 0.75 L + 0.75 S |
| Bending/Compression | N/A    | 1       | Passed (N/A) | --   | N/A                     |

- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.

| Supports | Type  | Material |
|----------|-------|----------|
| Base     | Plate | Steel    |

Member Type : Free Standing Post  
Building Code : IBC 2018  
Design Methodology : ASD

| Max Unbraced Length | Comments            |
|---------------------|---------------------|
| Full Member Length  | No bracing assumed. |

Drawing is Conceptual

| Vertical Loads | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments  |
|----------------|-------------|-------------------|-------------|---|
| 1 - Point (lb) | 4039        | 2262              | 885         | Linked from: Rev 1 UB1 - Garage Door Header, 9'-6", Support 1 |
| 2 - Point (lb) | 4039        | 2262              | 885         | Linked from: Rev 1 UB1 - Garage Door Header, 9'-6", Support 1 |

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

|   |           |
|---|-----------|
| ForteWEB Software Operator  | Job Notes |
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |

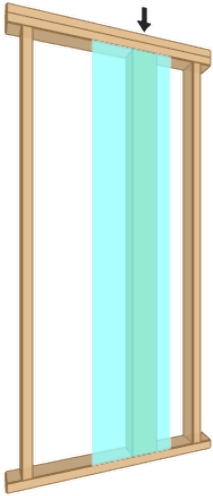


Main Floor, Rev 1 P3 - Living Room Wall Post, Grid 1  
1 piece(s) 6 x 6 DF No.1

Wall Height: 8'

Member Height: 7' 7 1/2"

Tributary Width: 1'



Drawing is Conceptual

| Design Results          | Actual          | Allowed | Result          | LDF  | Load: Combination                |
|-------------------------|-----------------|---------|-----------------|------|----------------------------------|
| Slenderness             | 17              | 50      | Passed (33%)    | --   | --                               |
| Compression (lbs)       | 11240           | 28163   | Passed (40%)    | 1.15 | 1.0 D + 1.0 S                    |
| Plate Bearing (lbs)     | 11240           | 12251   | Passed (92%)    | --   | 1.0 D + 1.0 S                    |
| Lateral Reaction (lbs)  | 41              | --      | --              | 1.60 | 1.0 D + 0.6 W                    |
| Lateral Shear (lbs)     | 36              | 5485    | Passed (1%)     | 1.60 | 1.0 D + 0.6 W                    |
| Lateral Moment (ft-lbs) | 79 @ mid-span   | 4437    | Passed (2%)     | 1.60 | 1.0 D + 0.6 W                    |
| Total Deflection (in)   | 0.03 @ mid-span | 0.76    | Passed (L/3261) | --   | 1.0 D + 0.45 W + 0.75 L + 0.75 S |
| Bending/Compression     | 0.38            | 1       | Passed (38%)    | 1.15 | 1.0 D + 1.0 S                    |

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for this design is 10% of applicable member side dimension.
- Applicable calculations are based on NDS.
- Bearing shall be on a metal plate or strap, or on other equivalently durable, rigid, homogeneous material with sufficient stiffness to distribute applied load.
- This product has a square cross section. The analysis engine has checked both edge and plank orientations to allow for either installation.

| Supports | Type   | Material |
|----------|--------|----------|
| Top      | Dbl 2X | Hem Fir  |
| Base     | 2X     | Hem Fir  |

System : Wall  
Member Type : Column  
Building Code : IBC 2018  
Design Methodology : ASD

| Max Unbraced Length | Comments |
|---------------------|----------|
| 7' 7 1/2"           |          |

| Lateral Connections |           |                            |          |                   |
|---------------------|-----------|----------------------------|----------|-------------------|
| Supports            | Connector | Type/Model                 | Quantity | Connector Nailing |
| Top                 | Nails     | 8d (0.113" x 2 1/2") (Toe) | 2        | N/A               |
| Base                | Nails     | 8d (0.113" x 2 1/2") (Toe) | 2        | N/A               |

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

| Vertical Loads | Tributary Width | Dead (0.90) | Snow (1.15) | Comments   |
|----------------|-----------------|-------------|-------------|--|
| 1 - Point (lb) | N/A             | 1100        | 1200        | Deck Roof Beam   |
| 2 - Point (lb) | N/A             | 5659        | 3281        | Linked from: RB - Living Room Roof Beam, Grid B, Support 1 |

| Lateral Load      | Location    | Tributary Width | Wind (1.60) | Comments |
|-------------------|-------------|-----------------|-------------|----------|
| 1 - Uniform (PSF) | Full Length | 1'              | 18.1        |          |

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (97), Risk Category(II), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

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

|   |           |
|---|-----------|
| ForteWEB Software Operator  | Job Notes |
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |





Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Steel Beam**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION: Rev 1 - Main Floor B7 - Deck Beam, Grid C**

**Maximum Forces & Stresses for Load Combinations**

| Load Combination        | Segment Length | Span # | Max Stress Ratios |       | Summary of Moment Values |        |        |        |              | Summary of Shear Values |        |               |        |        |
|-------------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|--------------|-------------------------|--------|---------------|--------|--------|
|                         |                |        | M                 | V     | Mmax +                   | Mmax - | Ma Max | Mnx    | Mnx/Omega Cb | Rm                      | Va Max | Vnx/Vnx/Omega |        |        |
| Dsgn. L = 16.00 ft      | 16.00 ft       | 1      | 0.244             | 0.064 | 18.97                    | -14.38 | 18.97  | 129.57 | 77.58        | 1.00                    | 1.00   | 6.59          | 172.48 | 103.28 |
| Dsgn. L = 8.75 ft       | 8.75 ft        | 2      | 0.185             | 0.032 |                          | -14.38 | 14.38  | 129.57 | 77.58        | 1.00                    | 1.00   | 3.29          | 172.48 | 103.28 |
| <b>+D+0.750L</b>        |                |        |                   |       |                          |        |        |        |              |                         |        |               |        |        |
| Dsgn. L = 16.00 ft      | 16.00 ft       | 1      | 0.637             | 0.125 | 49.43                    | -18.11 | 49.43  | 129.57 | 77.58        | 1.00                    | 1.00   | 12.89         | 172.48 | 103.28 |
| Dsgn. L = 8.75 ft       | 8.75 ft        | 2      | 0.233             | 0.040 |                          | -18.11 | 18.11  | 129.57 | 77.58        | 1.00                    | 1.00   | 4.14          | 172.48 | 103.28 |
| <b>+D+0.750L+0.750S</b> |                |        |                   |       |                          |        |        |        |              |                         |        |               |        |        |
| Dsgn. L = 16.00 ft      | 16.00 ft       | 1      | 0.623             | 0.136 | 48.34                    | -23.71 | 48.34  | 129.57 | 77.58        | 1.00                    | 1.00   | 14.04         | 172.48 | 103.28 |
| Dsgn. L = 8.75 ft       | 8.75 ft        | 2      | 0.306             | 0.052 |                          | -23.71 | 23.71  | 129.57 | 77.58        | 1.00                    | 1.00   | 5.42          | 172.48 | 103.28 |
| <b>+0.60D</b>           |                |        |                   |       |                          |        |        |        |              |                         |        |               |        |        |
| Dsgn. L = 16.00 ft      | 16.00 ft       | 1      | 0.158             | 0.029 | 12.25                    | -4.15  | 12.25  | 129.57 | 77.58        | 1.00                    | 1.00   | 3.04          | 172.48 | 103.28 |
| Dsgn. L = 8.75 ft       | 8.75 ft        | 2      | 0.053             | 0.009 |                          | -4.15  | 4.15   | 129.57 | 77.58        | 1.00                    | 1.00   | 0.95          | 172.48 | 103.28 |

**Overall Maximum Deflections**

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+L             | 1    | 0.6118        | 8.128            |                  | 0.0000        | 0.000            |
|                  | 2    | 0.0000        | 8.128            | +D+L             | -0.7223       | 8.750            |

**Vertical Reactions**

Support notation : Far left is #

Values in KIPS

| Load Combination                            | Support 1 | Support 2 | Support 3 |
|---|-----------|-----------|-----------|
| Max Upward from all Load Conditions         | 10.564    | 20.499    |           |
| Max Upward from Load Combinations           | 10.564    | 20.499    |           |
| Max Upward from Load Cases                  | 7.066     | 13.857    |           |
| Max Downward from all Load Conditions (Resi | -0.168    |           |           |
| Max Downward from Load Cases (Resisting U   | -0.168    |           |           |
| D Only                                      | 3.498     | 6.642     |           |
| +D+L  | 10.564    | 20.499    |           |
| +D+S  | 3.330     | 9.881     |           |
| +D+0.750L                                   | 8.797     | 17.035    |           |
| +D+0.750L+0.750S                            | 8.671     | 19.464    |           |
| +0.60D                                      | 2.099     | 3.985     |           |
| L Only                                      | 7.066     | 13.857    |           |
| S Only                                      | -0.168    | 3.239     |           |

## Steel Column

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

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**DESCRIPTION:** Rev 1 - Main Floor P7 - Steel Living Room Column

### Code References

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combinations Used : ASCE 7-16

### General Information

|  |  |                     |
|--|--|---------------------|
| Steel Section Name : <b>HSS4x4x1/4</b>   | Overall Column Height  | 15.0 ft             |
| Analysis Method : Allowable Strength     | Top & Bottom Fixity  | Top & Bottom Pinned |
| Steel Stress Grade                       | Brace condition :  |                     |
| Fy : Steel Yield 46.0 ksi                | Unbraced Length for buckling ABOUT X-X Axis = 15.0 ft, K = 1.0 |                     |
| E : Elastic Bending Modulus 29,000.0 ksi | Unbraced Length for buckling ABOUT Y-Y Axis = 15.0 ft, K = 1.0 |                     |

### Applied Loads

Service loads entered. Load Factors will be applied for calculations

Column self weight included : 183.150 lbs \* Dead Load Factor  
 AXIAL LOADS . . .  
 Roof Beam: Axial Load at 15.0 ft, D = 5.20, S = 7.0 k  
 Floor Beam UB13: Axial Load at 15.0 ft, D = 3.150, L = 4.520 k

### DESIGN SUMMARY

#### Bending & Shear Check Results

**PASS** Max. Axial+Bending Stress Ratio = **0.4754** : 1  
 Load Combination +D+0.750L+0.750S  
 Location of max.above base 0.0 ft  
 At maximum location values are . . .

|                          |             |
|--------------------------|-------------|
| Pa : Axial               | 17.173 k    |
| Pn / Omega : Allowable   | 36.120 k    |
| Ma-x : Applied           | 0.0 k-ft    |
| Mn-x / Omega : Allowable | 10.765 k-ft |
| Ma-y : Applied           | 0.0 k-ft    |
| Mn-y / Omega : Allowable | 10.765 k-ft |

**PASS** Maximum Shear Stress Ratio = **0.0** : 1  
 Load Combination 0.0  
 Location of max.above base 0.0 ft  
 At maximum location values are . . .

|                        |       |
|------------------------|-------|
| Va : Applied           | 0.0 k |
| Vn / Omega : Allowable | 0.0 k |

#### Maximum Load Reactions . .

|                  |       |
|------------------|-------|
| Top along X-X    | 0.0 k |
| Bottom along X-X | 0.0 k |
| Top along Y-Y    | 0.0 k |
| Bottom along Y-Y | 0.0 k |

#### Maximum Load Deflections . . .

|                        |           |                  |
|------------------------|-----------|------------------|
| Along Y-Y              | 0.0 in at | 0.0ft above base |
| for load combination : |           |                  |
| Along X-X              | 0.0 in at | 0.0ft above base |
| for load combination : |           |                  |

### Load Combination Results

| Load Combination | Maximum Axial + Bending Stress Ratios |        |          |      | Maximum Shear Ratios |         |         |              |        |          |
|------------------|---------------------------------------|--------|----------|------|----------------------|---------|---------|--------------|--------|----------|
|                  | Stress Ratio                          | Status | Location | Cbx  | Cby                  | KxLx/Ry | KyLy/Rx | Stress Ratio | Status | Location |
| D Only           | 0.236                                 | PASS   | 0.00 ft  | 1.00 | 1.00                 | 118.42  | 118.42  | 0.000        | PASS   | 0.00 ft  |
| +D+L             | 0.361                                 | PASS   | 0.00 ft  | 1.00 | 1.00                 | 118.42  | 118.42  | 0.000        | PASS   | 0.00 ft  |
| +D+S             | 0.430                                 | PASS   | 0.00 ft  | 1.00 | 1.00                 | 118.42  | 118.42  | 0.000        | PASS   | 0.00 ft  |
| +D+0.750L        | 0.330                                 | PASS   | 0.00 ft  | 1.00 | 1.00                 | 118.42  | 118.42  | 0.000        | PASS   | 0.00 ft  |
| +D+0.750L+0.750S | 0.475                                 | PASS   | 0.00 ft  | 1.00 | 1.00                 | 118.42  | 118.42  | 0.000        | PASS   | 0.00 ft  |
| +0.60D           | 0.142                                 | PASS   | 0.00 ft  | 1.00 | 1.00                 | 118.42  | 118.42  | 0.000        | PASS   | 0.00 ft  |

### Maximum Reactions

Note: Only non-zero reactions are listed.

| Load Combination | Axial Reaction @ Base | X-X Axis Reaction @ Base @ Top | k | Y-Y Axis Reaction @ Base @ Top | Mx - End Moments @ Base @ Top | k-ft | My - End Moments @ Base @ Top |
|------------------|-----------------------|--------------------------------|---|--------------------------------|-------------------------------|------|-------------------------------|
| D Only           | 8.533                 |                                |   |                                |                               |      |                               |
| +D+L             | 13.053                |                                |   |                                |                               |      |                               |
| +D+S             | 15.533                |                                |   |                                |                               |      |                               |
| +D+0.750L        | 11.923                |                                |   |                                |                               |      |                               |
| +D+0.750L+0.750S | 17.173                |                                |   |                                |                               |      |                               |
| +0.60D           | 5.120                 |                                |   |                                |                               |      |                               |
| L Only           | 4.520                 |                                |   |                                |                               |      |                               |
| S Only           | 7.000                 |                                |   |                                |                               |      |                               |



Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Steel Column

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

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### DESCRIPTION: Rev 1 - Main Floor P7 - Steel Living Room Column

#### Extreme Reactions

| Item                    | Extreme Value | Axial Reaction |       | X-X Axis Reaction |       | Y-Y Axis Reaction |       | Mx - End Moments |       | My - End Moments |       |
|-------------------------|---------------|----------------|-------|-------------------|-------|-------------------|-------|------------------|-------|------------------|-------|
|                         |               | @ Base         | @ Top | @ Base            | @ Top | @ Base            | @ Top | @ Base           | @ Top | @ Base           | @ Top |
| Axial @ Base            | Maximum       | 17.173         |       |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 4.520          |       |                   |       |                   |       |                  |       |                  |       |
| Reaction, X-X Axis Base | Maximum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| Reaction, Y-Y Axis Base | Maximum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| Reaction, X-X Axis Top  | Maximum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| Reaction, Y-Y Axis Top  | Maximum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| Moment, X-X Axis Base   | Maximum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| Moment, Y-Y Axis Base   | Maximum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| Moment, X-X Axis Top    | Maximum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| Moment, Y-Y Axis Top    | Maximum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 8.533          |       |                   |       |                   |       |                  |       |                  |       |

#### Maximum Deflections for Load Combinations

| Load Combination | Max. Deflection in X dir | Distance | Max. Deflection in Y dir | Distance |
|------------------|--------------------------|----------|--------------------------|----------|
| D Only           | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +D+L             | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +D+S             | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +D+0.750L        | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +D+0.750L+0.750S | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +0.60D           | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| L Only           | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| S Only           | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |

#### Steel Section Properties : HSS4x4x1/4

|              |   |                       |      |   |                       |   |   |                        |
|--------------|---|-----------------------|------|---|-----------------------|---|---|------------------------|
| Depth        | = | 4.000 in              | I xx | = | 7.80 in <sup>4</sup>  | J | = | 12.800 in <sup>4</sup> |
| Design Thick | = | 0.233 in              | S xx | = | 3.90 in <sup>3</sup>  |   |   |                        |
| Width        | = | 4.000 in              | R xx | = | 1.520 in              |   |   |                        |
| Wall Thick   | = | 0.250 in              | Zx   | = | 4.690 in <sup>3</sup> |   |   |                        |
| Area         | = | 3.370 in <sup>2</sup> | I yy | = | 7.800 in <sup>4</sup> | C | = | 6.560 in <sup>3</sup>  |
| Weight       | = | 12.210 plf            | S yy | = | 3.900 in <sup>3</sup> |   |   |                        |
|              |   |                       | R yy | = | 1.520 in              |   |   |                        |
| Ycg          | = | 0.000 in              |      |   |                       |   |   |                        |

## Steel Column

Project File: Hong Kao - Rev 1.ec6

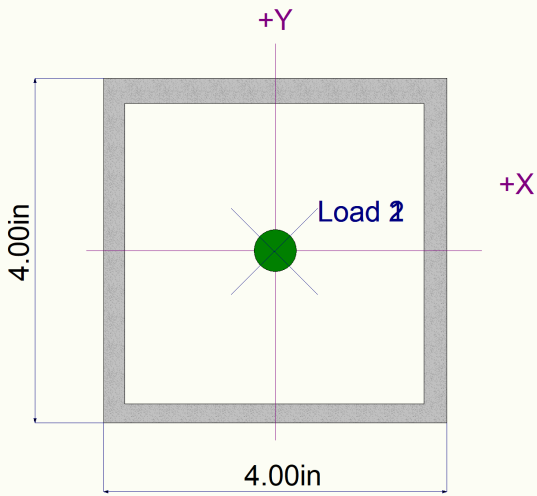
LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION:** Rev 1 - Main Floor P7 - Steel Living Room Column

### Sketches





Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Steel Column

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

### DESCRIPTION: Rev 1 - Crawspace BP4 - Crawspace Column

#### Extreme Reactions

| Item                    | Extreme Value | Axial Reaction | X-X Axis Reaction |       | Y-Y Axis Reaction |       | Mx - End Moments |       | My - End Moments |       |
|-------------------------|---------------|----------------|-------------------|-------|-------------------|-------|------------------|-------|------------------|-------|
|                         |               | @ Base         | @ Base            | @ Top | @ Base            | @ Top | @ Base           | @ Top | @ Base           | @ Top |
| Axial @ Base            | Maximum       | 28.072         |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 6.100          |                   |       |                   |       |                  |       |                  |       |
| Reaction, X-X Axis Base | Maximum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| Reaction, Y-Y Axis Base | Maximum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| Reaction, X-X Axis Top  | Maximum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| Reaction, Y-Y Axis Top  | Maximum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| Moment, X-X Axis Base   | Maximum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| Moment, Y-Y Axis Base   | Maximum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| Moment, X-X Axis Top    | Maximum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| Moment, Y-Y Axis Top    | Maximum       | 16.147         |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 16.147         |                   |       |                   |       |                  |       |                  |       |

#### Maximum Deflections for Load Combinations

| Load Combination | Max. Deflection in X dir | Distance | Max. Deflection in Y dir | Distance |
|------------------|--------------------------|----------|--------------------------|----------|
| D Only           | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +D+L             | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +D+S             | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +D+0.750L        | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +D+0.750L+0.750S | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +0.60D           | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| L Only           | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| S Only           | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |

#### Steel Section Properties : HSS4x4x1/4

|              |   |                       |      |   |                       |   |   |                        |
|--------------|---|-----------------------|------|---|-----------------------|---|---|------------------------|
| Depth        | = | 4.000 in              | I xx | = | 7.80 in <sup>4</sup>  | J | = | 12.800 in <sup>4</sup> |
| Design Thick | = | 0.233 in              | S xx | = | 3.90 in <sup>3</sup>  |   |   |                        |
| Width        | = | 4.000 in              | R xx | = | 1.520 in              |   |   |                        |
| Wall Thick   | = | 0.250 in              | Zx   | = | 4.690 in <sup>3</sup> |   |   |                        |
| Area         | = | 3.370 in <sup>2</sup> | I yy | = | 7.800 in <sup>4</sup> | C | = | 6.560 in <sup>3</sup>  |
| Weight       | = | 12.210 plf            | S yy | = | 3.900 in <sup>3</sup> |   |   |                        |
|              |   |                       | R yy | = | 1.520 in              |   |   |                        |
| Ycg          | = | 0.000 in              |      |   |                       |   |   |                        |

## Steel Column

Project File: Hong Kao - Rev 1.ec6

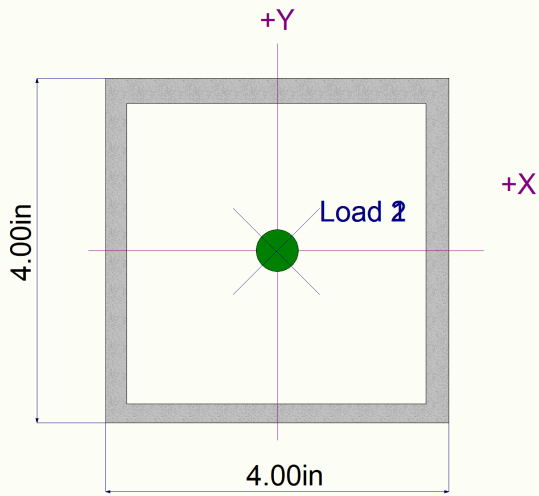
LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION:** Rev 1 - Crawspace BP4 - Crawspace Column

### Sketches





Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Steel Column

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

### DESCRIPTION: Rev 1 - Basement BP5 - Steel Deck Stair Column

#### Extreme Reactions

| Item                    | Extreme Value | Axial Reaction | X-X Axis Reaction |       | Y-Y Axis Reaction |       | Mx - End Moments |       | My - End Moments |       |
|-------------------------|---------------|----------------|-------------------|-------|-------------------|-------|------------------|-------|------------------|-------|
|                         |               | @ Base         | @ Base            | @ Top | @ Base            | @ Top | @ Base           | @ Top | @ Base           | @ Top |
| Axial @ Base            | Maximum       | 6.262          |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 1.084          |                   |       |                   |       |                  |       |                  |       |
| Reaction, X-X Axis Base | Maximum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| Reaction, Y-Y Axis Base | Maximum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| Reaction, X-X Axis Top  | Maximum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| Reaction, Y-Y Axis Top  | Maximum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| Moment, X-X Axis Base   | Maximum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| Moment, Y-Y Axis Base   | Maximum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| Moment, X-X Axis Top    | Maximum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| Moment, Y-Y Axis Top    | Maximum       | 1.807          |                   |       |                   |       |                  |       |                  |       |
| "                       | Minimum       | 1.807          |                   |       |                   |       |                  |       |                  |       |

#### Maximum Deflections for Load Combinations

| Load Combination | Max. Deflection in X dir | Distance | Max. Deflection in Y dir | Distance |
|------------------|--------------------------|----------|--------------------------|----------|
| D Only           | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +D+L             | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +D+S             | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +D+0.750L        | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +D+0.750L+0.750S | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| +0.60D           | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| L Only           | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |
| S Only           | 0.0000 in                | 0.000 ft | 0.000 in                 | 0.000 ft |

#### Steel Section Properties : HSS12x2x1/4

|              |   |                       |      |   |                        |    |   |                        |
|--------------|---|-----------------------|------|---|------------------------|----|---|------------------------|
| Depth        | = | 12.000 in             | I xx | = | 86.90 in <sup>4</sup>  | J  | = | 15.100 in <sup>4</sup> |
| Design Thick | = | 0.233 in              | S xx | = | 14.50 in <sup>3</sup>  | Cw | = | 9.64 in <sup>6</sup>   |
| Width        | = | 2.000 in              | R xx | = | 3.750 in               |    |   |                        |
| Wall Thick   | = | 0.250 in              | Zx   | = | 20.100 in <sup>3</sup> |    |   |                        |
| Area         | = | 6.170 in <sup>2</sup> | I yy | = | 4.410 in <sup>4</sup>  | C  | = | 9.640 in <sup>3</sup>  |
| Weight       | = | 22.420 plf            | S yy | = | 4.410 in <sup>3</sup>  |    |   |                        |
|              |   |                       | R yy | = | 0.845 in               |    |   |                        |
|              |   |                       | Zy   | = | 5.080 in <sup>3</sup>  |    |   |                        |
| Ycg          | = | 0.000 in              |      |   |                        |    |   |                        |

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Steel Column

Project File: Hong Kao - Rev 1.ec6

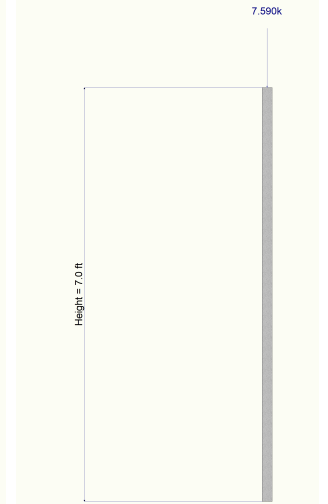
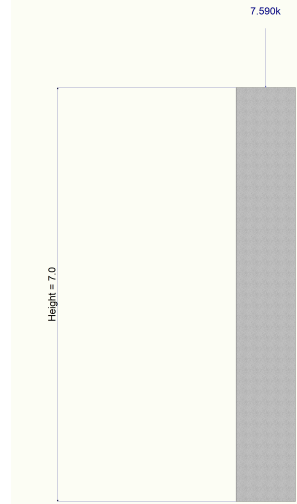
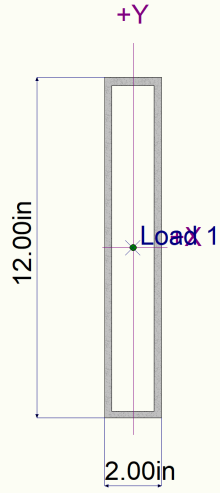
LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION:** Rev 1 - Basement BP5 - Steel Deck Stair Column

### Sketches





## Steel Beam

Project File: Hong Kao - Rev 1.ec6

LIC#: KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION:** Rev 1 - Main Floor B10 - Deck Stair Stringer

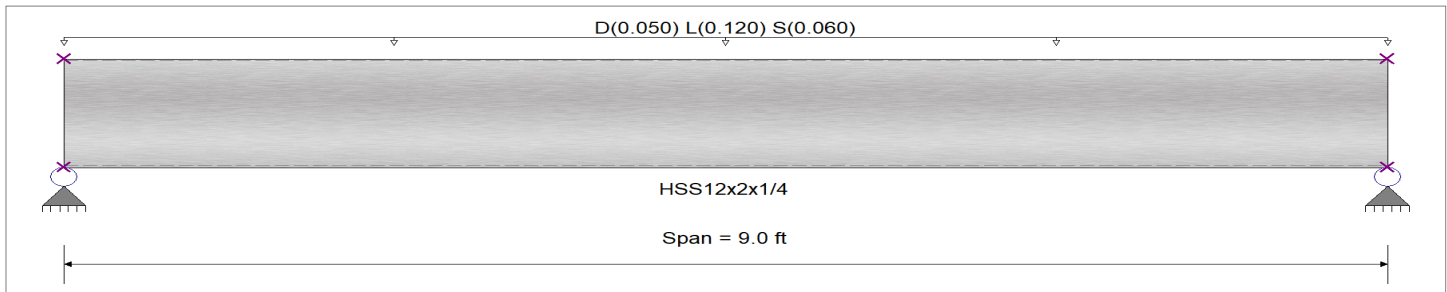
### CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

Analysis Method : Allowable Strength Design  
 Beam Bracing : Completely Unbraced  
 Bending Axis : Major Axis Bending

Fy : Steel Yield : 46.0 ksi  
 E: Modulus : 29,000.0 ksi



### Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight calculated and added to loading

Uniform Load : D = 0.0250, L = 0.060, S = 0.030 ksf, Tributary Width = 2.0 ft, (Stair)

### DESIGN SUMMARY

Design OK

|  |   |
|--|---|
| <p><b>Maximum Bending Stress Ratio</b> = <b>0.046 : 1</b></p> <p>Section used for this span: <b>HSS12x2x1/4</b></p> <p>Ma : Applied: 2.100 k-ft</p> <p>Mn / Omega : Allowable: 46.138 k-ft</p> <p>Load Combination: +D+0.750L+0.750S</p> <p>Span # where maximum occurs: Span # 1</p> <p><b>Maximum Deflection</b></p> <p>Max Downward Transient Deflection: 0.007 in Ratio = 15,294 &gt;=360.0 Span: 1 : L Only</p> <p>Max Upward Transient Deflection: 0 in Ratio = 0 &lt;360.0 n/a</p> <p>Max Downward Total Deflection: 0.012 in Ratio = 8848 &gt;=240.0 Span: 1 : +D+0.750L+0.750S</p> <p>Max Upward Total Deflection: 0 in Ratio = 0 &lt;240.0 n/a</p> | <p><b>Maximum Shear Stress Ratio</b> = <b>0.011 : 1</b></p> <p>Section used for this span: <b>HSS12x2x1/4</b></p> <p>Va : Applied: 0.9334 k</p> <p>Vn / Omega : Allowable: 87.035 k</p> <p>Load Combination: +D+0.750L+0.750S</p> <p>Location of maximum on span: 0.000 ft</p> <p>Span # where maximum occurs: Span # 1</p> |
|--|---|

### Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios |       | Summary of Moment Values |        |        |       |           |      | Summary of Shear Values |        |        |           |  |
|------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|-------|-----------|------|-------------------------|--------|--------|-----------|--|
|                  |                |        | M                 | V     | Mmax +                   | Mmax - | Ma Max | Mnx   | Mnx/Omega | Cb   | Rm                      | Va Max | Vnx    | Vnx/Omega |  |
| D Only           |                |        |                   |       |                          |        |        |       |           |      |                         |        |        |           |  |
| Dsgn. L =        | 9.00 ft        | 1      | 0.016             | 0.004 | 0.73                     |        | 0.73   | 77.05 | 46.14     | 1.14 | 1.00                    | 0.33   | 145.35 | 87.04     |  |
| +D+L             |                |        |                   |       |                          |        |        |       |           |      |                         |        |        |           |  |
| Dsgn. L =        | 9.00 ft        | 1      | 0.042             | 0.010 | 1.95                     |        | 1.95   | 77.05 | 46.14     | 1.14 | 1.00                    | 0.87   | 145.35 | 87.04     |  |
| +D+S             |                |        |                   |       |                          |        |        |       |           |      |                         |        |        |           |  |
| Dsgn. L =        | 9.00 ft        | 1      | 0.029             | 0.007 | 1.34                     |        | 1.34   | 77.05 | 46.14     | 1.14 | 1.00                    | 0.60   | 145.35 | 87.04     |  |
| +D+0.750L        |                |        |                   |       |                          |        |        |       |           |      |                         |        |        |           |  |
| Dsgn. L =        | 9.00 ft        | 1      | 0.036             | 0.008 | 1.64                     |        | 1.64   | 77.05 | 46.14     | 1.14 | 1.00                    | 0.73   | 145.35 | 87.04     |  |
| +D+0.750L+0.750S |                |        |                   |       |                          |        |        |       |           |      |                         |        |        |           |  |
| Dsgn. L =        | 9.00 ft        | 1      | 0.046             | 0.011 | 2.10                     |        | 2.10   | 77.05 | 46.14     | 1.14 | 1.00                    | 0.93   | 145.35 | 87.04     |  |
| +0.60D           |                |        |                   |       |                          |        |        |       |           |      |                         |        |        |           |  |
| Dsgn. L =        | 9.00 ft        | 1      | 0.010             | 0.002 | 0.44                     |        | 0.44   | 77.05 | 46.14     | 1.14 | 1.00                    | 0.20   | 145.35 | 87.04     |  |

### Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+0.750L+0.750S | 1    | 0.0122        | 4.526            |                  | 0.0000        | 0.000            |

### Vertical Reactions

Support notation : Far left is #

Values in KIPS

| Load Combination                    | Support 1 | Support 2 |
|-------------------------------------|-----------|-----------|
| Max Upward from all Load Conditions | 0.933     | 0.933     |
| Max Upward from Load Combinations   | 0.933     | 0.933     |
| Max Upward from Load Cases          | 0.540     | 0.540     |

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Steel Beam

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION:** Rev 1 - Main Floor B10 - Deck Stair Stringer

### Vertical Reactions

Support notation : Far left is #

Values in KIPS

| Load Combination | Support 1 | Support 2 |
|------------------|-----------|-----------|
| D Only           | 0.326     | 0.326     |
| +D+L             | 0.866     | 0.866     |
| +D+S             | 0.596     | 0.596     |
| +D+0.750L        | 0.731     | 0.731     |
| +D+0.750L+0.750S | 0.933     | 0.933     |
| +0.60D           | 0.196     | 0.196     |
| L Only           | 0.540     | 0.540     |
| S Only           | 0.270     | 0.270     |

**Steel Beam**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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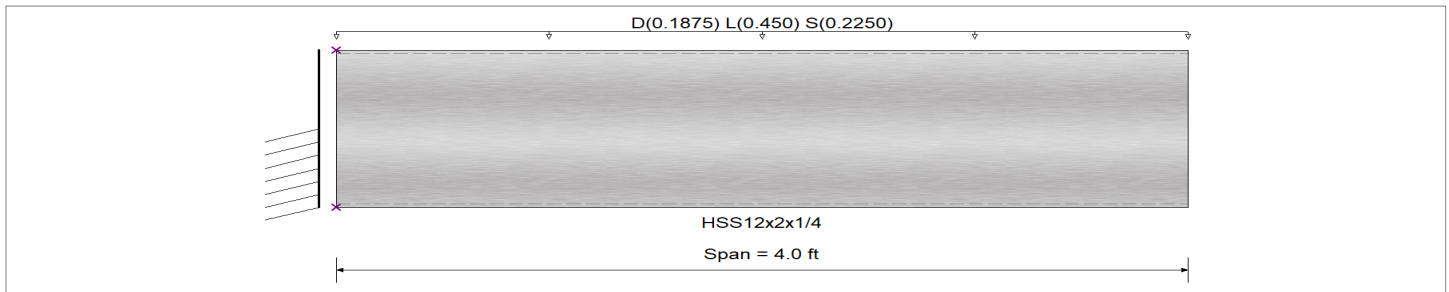
**DESCRIPTION:** Rev 1 - Main Floor B11 - Deck Stair Landing Beam

**CODE REFERENCES**

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

**Material Properties**

|   |                    |              |
|---|--------------------|--------------|
| Analysis Method : Allowable Strength Design | Fy : Steel Yield : | 46.0 ksi     |
| Beam Bracing : Completely Unbraced          | E: Modulus :       | 29,000.0 ksi |
| Bending Axis : Major Axis Bending           |                    |              |



**Applied Loads**

Service loads entered. Load Factors will be applied for calculations

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0250, L = 0.060, S = 0.030 ksf, Tributary Width = 7.50 ft, (Stair)

**DESIGN SUMMARY**

**Design OK**

|                                   |                                      |                              |                    |
|-----------------------------------|--------------------------------------|------------------------------|--------------------|
| Maximum Bending Stress Ratio =    | <b>0.124 : 1</b>                     | Maximum Shear Stress Ratio = | <b>0.033 : 1</b>   |
| Section used for this span        | <b>HSS12x2x1/4</b>                   | Section used for this span   | <b>HSS12x2x1/4</b> |
| Ma : Applied                      | 5.729 k-ft                           | Va : Applied                 | 2.865 k            |
| Mn / Omega : Allowable            | 46.138 k-ft                          | Vn/Omega : Allowable         | 87.035 k           |
| Load Combination                  | +D+0.750L+0.750S                     | Load Combination             | +D+0.750L+0.750S   |
| Span # where maximum occurs       | Span # 1                             | Location of maximum on span  | 0.000 ft           |
|                                   |                                      | Span # where maximum occurs  | Span # 1           |
| <b>Maximum Deflection</b>         |                                      |                              |                    |
| Max Downward Transient Deflection | 0.010 in Ratio = <b>9,741</b> >=360. | Span: 1 : L Only             |                    |
| Max Upward Transient Deflection   | 0 in Ratio = <b>0</b> <360.0         | n/a                          |                    |
| Max Downward Total Deflection     | 0.016 in Ratio = <b>6121</b> >=240.  | Span: 1 : +D+0.750L+0.750S   |                    |
| Max Upward Total Deflection       | 0 in Ratio = <b>0</b> <240.0         | n/a                          |                    |

**Maximum Forces & Stresses for Load Combinations**

| Load Combination | Segment Length | Span # | Max Stress Ratios |       | Summary of Moment Values |        |        |       |           |      | Summary of Shear Values |        |        |           |
|------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|-------|-----------|------|-------------------------|--------|--------|-----------|
|                  |                |        | M                 | V     | Mmax +                   | Mmax - | Ma Max | Mnx   | Mnx/Omega | Cb   | Rm                      | Va Max | Vnx    | Vnx/Omega |
| D Only           |                |        |                   |       |                          |        |        |       |           |      |                         |        |        |           |
| Dsgn. L =        | 4.00 ft        | 1      | 0.036             | 0.010 |                          | -1.68  | 1.68   | 77.05 | 46.14     | 1.00 | 1.00                    | 0.84   | 145.35 | 87.04     |
| +D+L             |                |        |                   |       |                          |        |        |       |           |      |                         |        |        |           |
| Dsgn. L =        | 4.00 ft        | 1      | 0.114             | 0.030 |                          | -5.28  | 5.28   | 77.05 | 46.14     | 1.00 | 1.00                    | 2.64   | 145.35 | 87.04     |
| +D+S             |                |        |                   |       |                          |        |        |       |           |      |                         |        |        |           |
| Dsgn. L =        | 4.00 ft        | 1      | 0.075             | 0.020 |                          | -3.48  | 3.48   | 77.05 | 46.14     | 1.00 | 1.00                    | 1.74   | 145.35 | 87.04     |
| +D+0.750L        |                |        |                   |       |                          |        |        |       |           |      |                         |        |        |           |
| Dsgn. L =        | 4.00 ft        | 1      | 0.095             | 0.025 |                          | -4.38  | 4.38   | 77.05 | 46.14     | 1.00 | 1.00                    | 2.19   | 145.35 | 87.04     |
| +D+0.750L+0.750S |                |        |                   |       |                          |        |        |       |           |      |                         |        |        |           |
| Dsgn. L =        | 4.00 ft        | 1      | 0.124             | 0.033 |                          | -5.73  | 5.73   | 77.05 | 46.14     | 1.00 | 1.00                    | 2.86   | 145.35 | 87.04     |
| +0.60D           |                |        |                   |       |                          |        |        |       |           |      |                         |        |        |           |
| Dsgn. L =        | 4.00 ft        | 1      | 0.022             | 0.006 |                          | -1.01  | 1.01   | 77.05 | 46.14     | 1.00 | 1.00                    | 0.50   | 145.35 | 87.04     |

**Overall Maximum Deflections**

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+0.750L+0.750S | 1    | 0.0157        | 4.000            |                  | 0.0000        | 0.000            |

**Vertical Reactions**

Support notation : Far left is #

Values in KIPS

| Load Combination                    | Support 1 | Support 2 |
|-------------------------------------|-----------|-----------|
| Max Upward from all Load Conditions | 2.865     |           |
| Max Upward from Load Combinations   | 2.865     |           |
| Max Upward from Load Cases          | 1.800     |           |

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Steel Beam

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.10.02

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION:** Rev 1 - Main Floor B11 - Deck Stair Landing Beam

### Vertical Reactions

Support notation : Far left is #

Values in KIPS

| Load Combination | Support 1 | Support 2 |
|------------------|-----------|-----------|
| D Only           | 0.840     |           |
| +D+L             | 2.640     |           |
| +D+S             | 1.740     |           |
| +D+0.750L        | 2.190     |           |
| +D+0.750L+0.750S | 2.865     |           |
| +0.60D           | 0.504     |           |
| L Only           | 1.800     |           |
| S Only           | 0.900     |           |

## RAILING SUPPORT ANGLE

- support live loads per IRC 1607.8
- conservatively design for 50  $\frac{\text{lb}}{\text{ft}}$  railing

$$M_{\text{max}} = 50 \frac{\text{lb}}{\text{ft}} (38') = 1.90 \text{ k-in/ft}$$

L3 x 3 x 3/8" ✓ OK

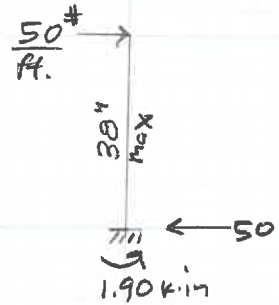
$$R \frac{3}{8}, l_{\text{cant.}} = 1.5'' - 0.5'' = 1''$$

$$W_{\text{vert}} = 8 \frac{\text{lb}}{\text{ft}} (3') + 50 \frac{\text{lb}}{\text{ft}} = 74 \frac{\text{lb}}{\text{ft}}$$

$$M_{\text{vert}} = 0.07 \text{ k-in/ft}$$

$$M_{\text{horiz}} = 1.90 \text{ k-in/ft} \quad \left. \vphantom{M_{\text{horiz}}}\right\} 2.0 \text{ k-in/ft}$$

$$R \frac{3}{8} S = \frac{12 \times 375^2}{6} = 0.28 \text{ in}^3 \quad f_b = \frac{M}{S} = 7.1 \text{ ksi} \ll F_b \text{ OK}$$



## LAG SCREW

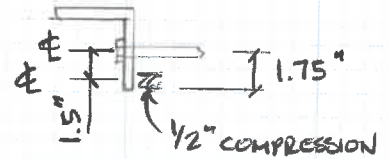
$$T/C = 2.0 \text{ k-in} / 1.5'' = 1.33''$$

$$f_{c1} = \frac{1.33''}{(0.5'' \times 12'')} = 222 \text{ psi} \leq F_{c1} \text{ OK}$$

TRY (2) 1/4 x 3 1/2 SDS

$$\text{Pullout} = (2) 385 \text{ lb} (2.0) = 1.54'' > 1.33'' \text{ OK}$$

∴ 1/4 x 3 1/2 SDS @ 6" o.c.



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HONG F KAO RESIDENCE

project

10/10/2023 23/27.01

date

project no.

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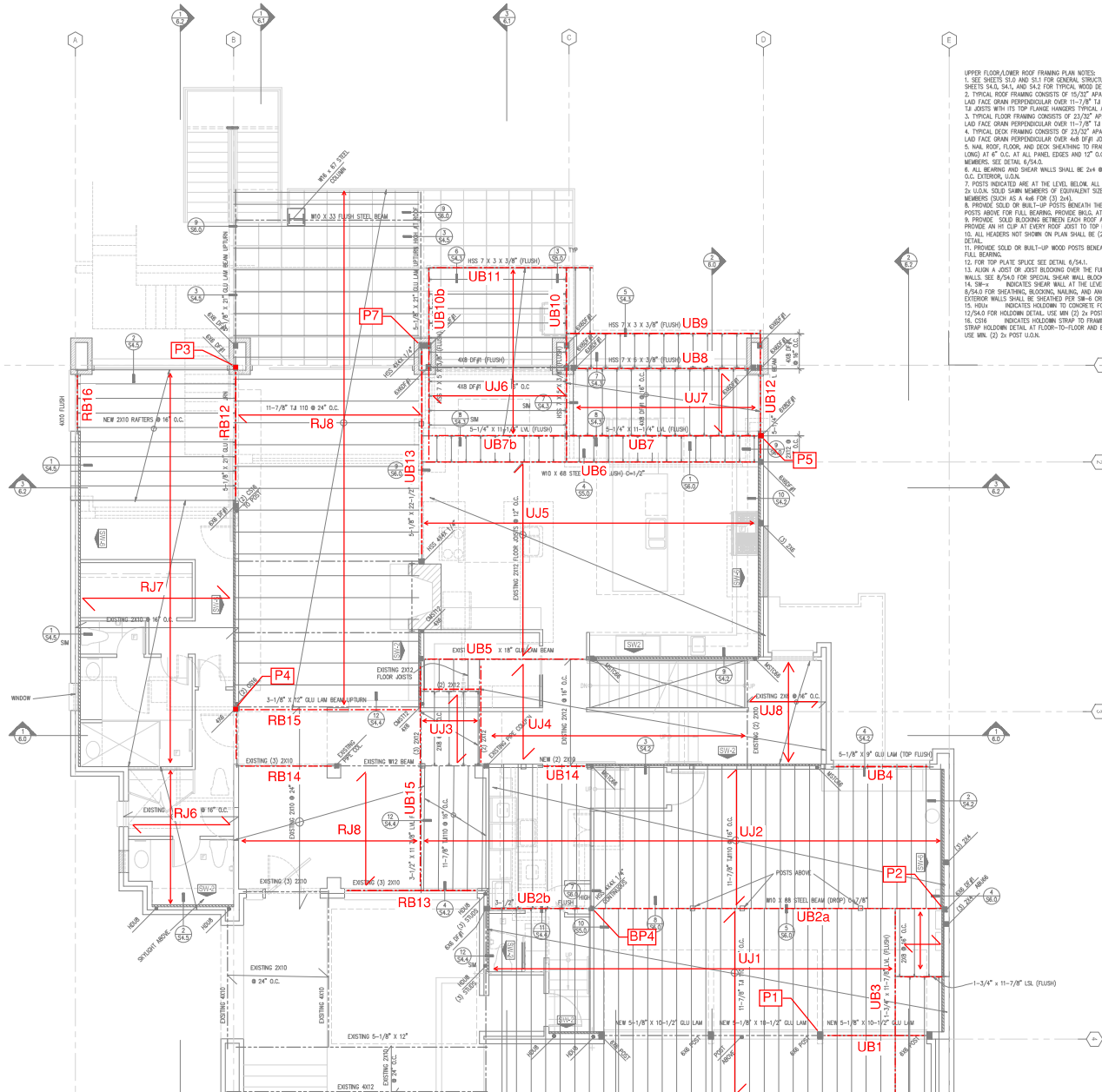
designer

sheet

CB

client

checked by



**Upper Floor Framing Key Plan**

- UPPER FLOOR/LOWER ROOF FRAMING PLAN NOTES:
- SEE SHEETS S3.0 AND S3.1 FOR GENERAL STRUCTURAL NOTES AND ABBREVIATIONS. SEE SHEETS S4.0, S4.1, AND S4.2 FOR TYPICAL WOOD DETAILS.
  - TYPICAL ROOF FRAMING CONSISTS OF 12/24" APA RATED SHEATHING INDEX 32/32, LAD FACE GRAM PERPENDICULAR OVER 11-7/8" T&B 110 JOISTS @ 24" O.C., U.O.G., HANG 12 JOISTS WITH ITS TOP FLANGES TYPICAL AT FLUSH BEAMS. U.O.G.
  - TYPICAL FLOOR FRAMING CONSISTS OF 23/27" APA RATED SHEATHING INDEX 48/24, LAD FACE GRAM PERPENDICULAR OVER 11-7/8" T&B 110 JOISTS @ 16" O.C., U.O.G.
  - TYPICAL DECK FRAMING CONSISTS OF 23/27" APA RATED SHEATHING INDEX 48/24, LAD FACE GRAM PERPENDICULAR OVER 48 DRIP JOISTS @ 16" O.C., U.O.G.
  - MAJ. ROOF, FLOOR, AND DECK SHEATHING TO FRAMING WITH 8# NAILS (5.13" @ 2.5" LONG) AT 6" O.C. AT ALL PANEL EDGES AND 12" O.C. AT INTERMEDIATE FRAMING MEMBERS. SEE DETAIL 6/24.0.
  - ALL BEARING AND SHEAR WALLS SHALL BE 2x4 @ 16" O.C. INTERIOR AND 2x6 @ 16" O.C. EXTERIOR. U.O.G.
  - POSTS INDICATED ARE AT THE LEVEL BELOW. ALL POSTS NOT SPECIFIED SHALL BE (2) 2x4 U.O.G. SOLID SAWN MEMBERS OF EQUIVALENT SIZE MAY BE SUBSTITUTED FOR BUILT-UP MEMBERS (SUCH AS A 6x6 FOR (3) 2x4).
  - PROVIDE SOLID OR BUILT-UP POSTS BENEATH THE ENDS OF ALL FLOOR BEAMS AND POSTS ABOVE FOR FULL BEARING. PROVIDE BRGS. AT JOISTS PER DETAIL 7/24.1.
  - PROVIDE SOLID BRIDGING BETWEEN EACH ROOF AND FLOOR JOIST AT SUPPORTS. PROVIDE AN HI CLIP AT EVERY ROOF JOIST TO TOP PLATE.
  - ALL HEADERS NOT SHOWN ON PLAN SHALL BE (2) 2x10. SEE 10/24.0 FOR HEADER DETAIL.
  - PROVIDE SOLID OR BUILT-UP WOOD POSTS BENEATH THE ENDS OF ALL BEAMS FOR FULL BEARING.
  - FOR TOP PLATE SPRUCE SEE DETAIL 6/24.1.
  - ALIGN A JOIST OR JOIST BLOTTING OVER THE FULL LENGTH OF ALL BEARING/SHEAR WALLS. SEE 6/24.0 FOR SPECIAL SHEAR WALL BLOTTING REQUIREMENTS.
  - SM-2 INDICATES SHEAR WALL AT THE LEVEL BELOW. SEE SHEAR WALL SCHEDULE 6/24.0 FOR BEARING, BLOCKING, NAILING, AND ANCHOR BOLT REQUIREMENTS. ALL EXTERIOR WALLS SHALL BE SHEATHED PER SM-6 CRITERIA, U.O.G.
  - 15' HIGH - INDICATES HOLDDOWN TO CONCRETE FOUNDATION WALLS OR FOOTINGS. SEE 12/24.0 FOR HOLDDOWN DETAIL. USE MIN (2) 2x4 POST U.O.G.
  - 16' CSR - INDICATES HOLDDOWN STRAP TO FRAMING BELOW WALL. SEE 10/24.0 FOR STRAP HOLDDOWN DETAIL AT FLOOR-TO-FLOOR AND BEAM SUPPORTING SHEAR WALL END. USE MIN (2) 2x POST U.O.G.

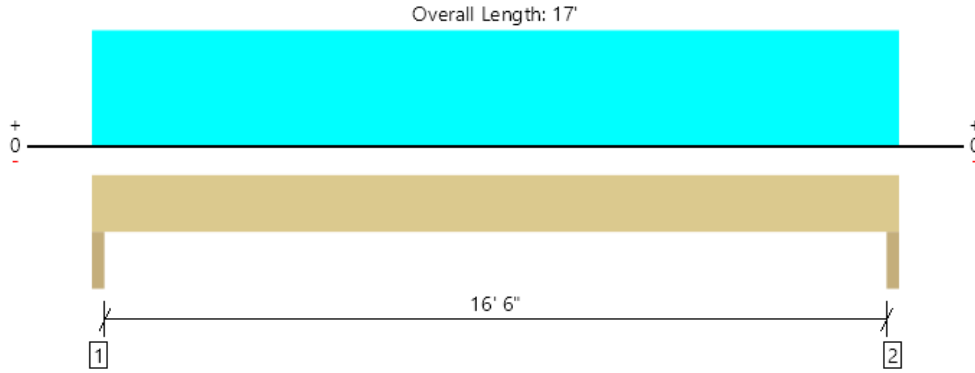
No. Date Revision

| Lower Roof   |         |   |          |
|--|---------|---|----------|
| Member Name  | Results | Current Solution                                    | Comments |
| Rev 1 RB15 - Living Room Flush Beam, Grid 3        | Passed  | 1 piece(s) 3 1/8" x 12" 24F-V4 DF Glulam            |          |
| Rev 1 RB13 - Existing Entry Header, 12'-0"         | Passed  | 3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL     |          |
| Upper Floor  |         |   |          |
| Member Name  | Results | Current Solution                                    | Comments |
| Rev 1 UJ2 - Exercise Floor Joist, 12'-6"           | Passed  | 1 piece(s) 11 7/8" TJI® 110 @ 16" OC                |          |
| Rev 1 UJ3 - Shower Floor Joist, 6'-0"              | Passed  | 1 piece(s) 2 x 8 HF No.2 @ 16" OC                   |          |
| Rev 1 UJ5 - Master Floor Joist, 18'-0"             | Passed  | 1 piece(s) 2 x 12 HF No.2 @ 12" OC                  |          |
| Rev 1 UJ8 - Landing Floor Joist, 7'-0"             | Passed  | 1 piece(s) 2 x 6 HF No.2 @ 16" OC                   |          |
| Rev 1 UB1 - Garage Door Header, 9'-6"              | Passed  | 1 piece(s) 5 1/8" x 10 1/2" 24F-V4 DF Glulam        |          |
| Rev 1 UB3 - Flush Beam at Shower, 11'-9"           | Passed  | 1 piece(s) 1 3/4" x 11 7/8" 1.55E TimberStrand® LSL |          |
| Rev 1 UB4 - Garage Window Header, 9'-6"            | Passed  | 1 piece(s) 5 1/8" x 9" 24F-V4 DF Glulam             |          |
| Rev 1 UB5 - Beam over Pantry, 15'-0"               | Passed  | 1 piece(s) 3 1/8" x 18" 24F-V4 DF Glulam            |          |
| Rev 1 UB7 - Flush Header at Master Window, 17'-0"  | Passed  | 3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL     |          |
| Rev 1 UB7b - Flush Header at Master Window, 13'-0" | Passed  | 3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL     |          |
| Rev 1 UB13 - Flush Beam over Dining, 19'-4"        | Passed  | 1 piece(s) 5 1/8" x 22 1/2" 24F-V4 DF Glulam        |          |
| Rev 1 UB14 - Utility Room Header, 5'-6"            | Passed  | 2 piece(s) 2 x 10 HF No.2                           |          |
| Rev 1 UB15 - Flush Beam over Entry, 11'-6"         | Passed  | 1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL |          |
| Main Floor   |         |   |          |
| Member Name  | Results | Current Solution                                    | Comments |
| Rev 1 J1 - Deck Joist, 13'-0"                      | Passed  | 1 piece(s) 2 x 12 DF No.2 @ 16" OC                  |          |
| Rev 1 J2 - Floor Joist, 14'-0"                     | Passed  | 1 piece(s) 2 x 12 HF No.2 @ 16" OC                  |          |
| Rev 1 J3 - Floor Joist, 17'-0"                     | Passed  | 1 piece(s) 2 x 12 DF No.2 @ 16" OC                  |          |
| Rev 1 J4 - Floor Joist, 18'-0"                     | Passed  | 1 piece(s) 2 x 12 DF No.2 @ 12" OC                  |          |
| Rev 1 J5 - Entry Floor Joist, 12'-0"               | Passed  | 1 piece(s) 2 x 8 DF No.1 @ 16" OC                   |          |
| Rev 1 B2 - Office Flush Beam, Grid A               | Passed  | 1 piece(s) 5 1/8" x 15" 24F-V4 DF Glulam            |          |
| Rev 1 B8 - Family Room Flush Beam, Grid C          | Passed  | 1 piece(s) 5 1/8" x 15" 24F-V4 DF Glulam            |          |
| Rev 1 B9 - Office Flush Beam, Grid 2               | Passed  | 1 piece(s) 5 1/8" x 10 1/2" 24F-V4 DF Glulam        |          |
| Rev 1 P1 - Garage Header Post                      | Passed  | 1 piece(s) 6 x 6 DF No.1                            |          |
| Rev 1 P3 - Living Room Wall Post, Grid 1           | Passed  | 1 piece(s) 6 x 6 DF No.1                            |          |

|   |           |
|---|-----------|
| ForteWEB Software Operator<br>Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com | Job Notes |
|---|-----------|



Lower Roof, Rev 1 RB15 - Living Room Flush Beam, Grid 3  
 1 piece(s) 3 1/8" x 12" 24F-V4 DF Glulam



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) | 3775 @ 1' 1/2"    | 6094 (3.00") | Passed (62%)   | --   | 1.0 D + 1.0 S (All Spans)   |
| Shear (lbs)           | 3220 @ 1' 3"      | 7619         | Passed (42%)   | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Pos Moment (Ft-lbs)   | 15575 @ 8' 6"     | 17250        | Passed (90%)   | 1.15 | 1.0 D + 1.0 S (All Spans)   |
| Live Load Defl. (in)  | 0.230 @ 8' 6"     | 0.837        | Passed (L/875) | --   | 1.0 D + 1.0 S (All Spans)   |
| Total Load Defl. (in) | 0.971 @ 8' 6"     | 1.117        | Passed (L/207) | --   | 1.0 D + 1.0 S (All Spans)   |

System : Roof  
 Member Type : Flush 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.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 16' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports         | Bearing Length |           |          | Loads to Supports (lbs) |      |          | Accessories |
|------------------|----------------|-----------|----------|-------------------------|------|----------|-------------|
|                  | Total          | Available | Required | Dead                    | Snow | Factored |             |
| 1 - Trimmer - HF | 3.00"          | 3.00"     | 1.86"    | 2882                    | 893  | 3775     | None        |
| 2 - Trimmer - HF | 3.00"          | 3.00"     | 1.86"    | 2882                    | 893  | 3775     | None        |

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 11' 2" o/c        |          |
| Bottom Edge (Lu) | 17' o/c           |          |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads        | Location (Side) | Tributary Width | Dead (0.90) | Snow (1.15) | Comments      |
|-----------------------|-----------------|-----------------|-------------|-------------|---------------|
| 0 - Self Weight (PLF) | 0 to 17'        | N/A             | 9.1         | --          |               |
| 1 - Uniform (PSF)     | 0 to 17' (Top)  | 1'              | 20.0        | 30.0        | Roof          |
| 2 - Uniform (PLF)     | 0 to 17' (Top)  | N/A             | 70.0        | -           | Wall Above    |
| 3 - Uniform (PSF)     | 0 to 17' (Top)  | 2' 6"           | 20.0        | 30.0        | Existing Roof |
| 4 - Uniform (PLF)     | 0 to 17' (Top)  | N/A             | 190.0       | -           | Veneer        |

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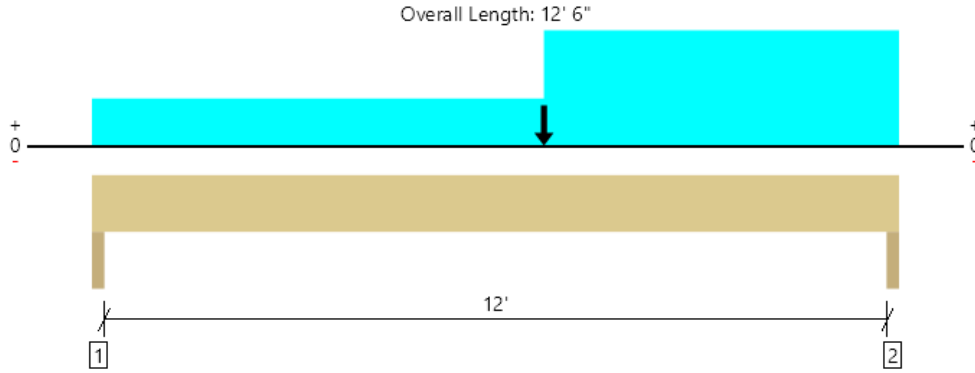
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

|   |           |
|---|-----------|
| ForteWEB Software Operator  | Job Notes |
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |





Lower Roof, Rev 1 RB13 - Existing Entry Header, 12'-0"  
3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL



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) | 6529 @ 12' 4 1/2"  | 11419 (3.00") | Passed (57%)    | --   | 1.0 D + 1.0 S (All Spans)   |
| Shear (lbs)           | 4460 @ 11' 3 1/8"  | 10661         | Passed (42%)    | 0.90 | 1.0 D (All Spans)           |
| Moment (Ft-lbs)       | 18057 @ 7'         | 24095         | Passed (75%)    | 0.90 | 1.0 D (All Spans)           |
| Live Load Defl. (in)  | 0.078 @ 6' 3 7/16" | 0.613         | Passed (L/999+) | --   | 1.0 D + 1.0 S (All Spans)   |
| Total Load Defl. (in) | 0.399 @ 6' 5 1/4"  | 0.817         | Passed (L/368)  | --   | 1.0 D + 1.0 S (All Spans)   |

System : Roof  
Member Type : Flush 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.

| Supports         | Bearing Length |           |          | Loads to Supports (lbs) |            |      |          | Accessories |
|------------------|----------------|-----------|----------|-------------------------|------------|------|----------|-------------|
|                  | Total          | Available | Required | Dead                    | Floor Live | Snow | Factored |             |
| 1 - Trimmer - HF | 3.00"          | 3.00"     | 1.50"    | 3338                    | 107        | 1164 | 4502     | None        |
| 2 - Trimmer - HF | 3.00"          | 3.00"     | 1.72"    | 5327                    | 136        | 1201 | 6529     | None        |

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 12' 1" o/c        |          |
| Bottom Edge (Lu) | 12' 6" o/c        |          |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads        | Location (Side)    | Tributary Width | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments   |
|-----------------------|--------------------|-----------------|-------------|-------------------|-------------|--|
| 0 - Self Weight (PLF) | 0 to 12' 6"        | N/A             | 18.2        | --                | --          |  |
| 1 - Uniform (PSF)     | 0 to 12' 6" (Top)  | 5' 6"           | 33.0        | -                 | 30.0        | Roof w/ Gravel   |
| 2 - Uniform (PLF)     | 7' to 12' 6" (Top) | N/A             | 500.0       | -                 | -           |  |
| 3 - Point (lb)        | 7' (Front)         | N/A             | 3419        | 243               | 303         | Linked from: Rev 1 UB15 - Flush Beam over Entry, 11'-6", Support 2 |

**Weyerhaeuser Notes**

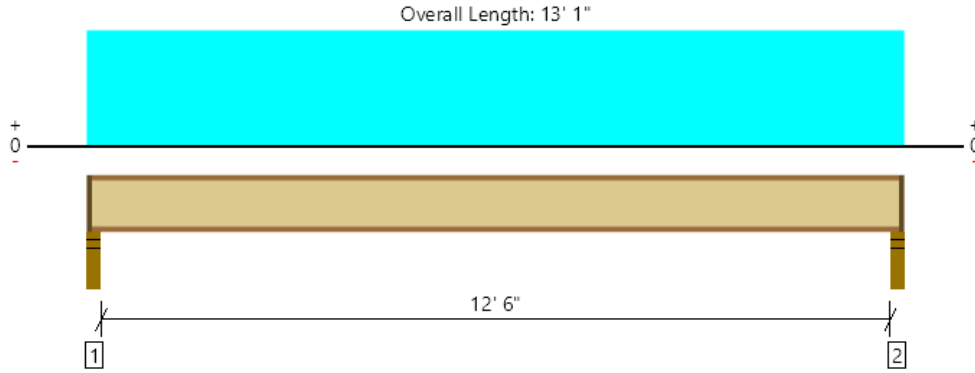
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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

|   |           |
|---|-----------|
| ForteWEB Software Operator  | Job Notes |
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Upper Floor, Rev 1 UJ2 - Exercise Floor Joist, 12'-6"  
1 piece(s) 11 7/8" TJI @ 110 @ 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) | 472 @ 2 1/2"      | 1041 (2.25") | Passed (45%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 458 @ 3 1/2"      | 1560         | Passed (29%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 1471 @ 6' 6 1/2"  | 3160         | Passed (47%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.111 @ 6' 6 1/2" | 0.317        | Passed (L/999+) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.153 @ 6' 6 1/2" | 0.633        | Passed (L/994)  | --   | 1.0 D + 1.0 L (All Spans)   |
| TJ-Pro™ Rating        | 54                | 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™ Rating include: None.

| Supports           | Bearing Length |           |          | Loads to Supports (lbs) |            |          | Accessories      |
|--------------------|----------------|-----------|----------|-------------------------|------------|----------|------------------|
|                    | Total          | Available | Required | Dead                    | Floor Live | Factored |                  |
| 1 - Stud wall - HF | 3.50"          | 2.25"     | 1.75"    | 131                     | 349        | 480      | 1 1/4" Rim Board |
| 2 - Stud wall - HF | 3.50"          | 2.25"     | 1.75"    | 131                     | 349        | 480      | 1 1/4" Rim Board |

• Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 4' 8" o/c         |          |
| Bottom Edge (Lu) | 12' 11" o/c       |          |

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

| Vertical Load     | Location    | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|-------------------|-------------|---------|-------------|-------------------|----------|
| 1 - Uniform (PSF) | 0 to 13' 1" | 16"     | 15.0        | 40.0              | Floor    |

**Weyerhaeuser Notes**

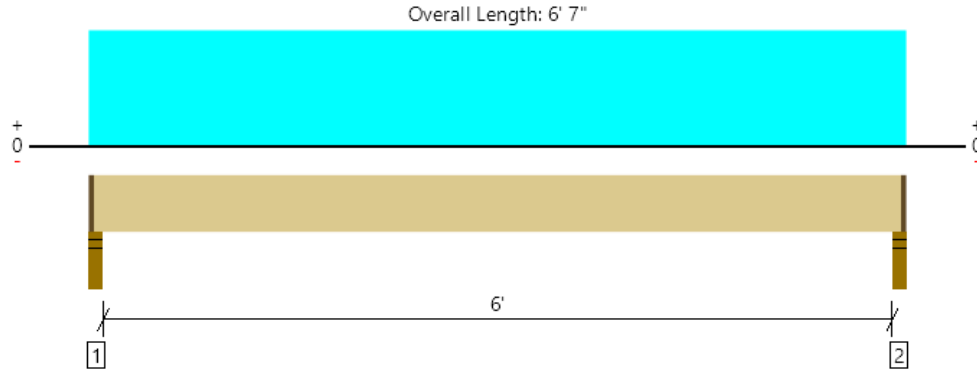
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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator  | Job Notes |
|---|-----------|
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Upper Floor, Rev 1 UJ3 - Shower Floor Joist, 6'-0"  
1 piece(s) 2 x 8 HF No.2 @ 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) | 234 @ 2 1/2"      | 1367 (2.25") | Passed (17%)    | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 176 @ 10 3/4"     | 1088         | Passed (16%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 349 @ 3' 3 1/2"   | 1284         | Passed (27%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.028 @ 3' 3 1/2" | 0.154        | Passed (L/999+) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.039 @ 3' 3 1/2" | 0.308        | Passed (L/999+) | --   | 1.0 D + 1.0 L (All Spans)   |
| TJ-Pro™ 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.

| Supports           | Bearing Length |           |          | Loads to Supports (lbs) |            |          | Accessories      |
|--------------------|----------------|-----------|----------|-------------------------|------------|----------|------------------|
|                    | Total          | Available | Required | Dead                    | Floor Live | Factored |                  |
| 1 - Stud wall - HF | 3.50"          | 2.25"     | 1.50"    | 66                      | 176        | 241      | 1 1/4" Rim Board |
| 2 - Stud wall - HF | 3.50"          | 2.25"     | 1.50"    | 66                      | 176        | 241      | 1 1/4" Rim Board |

• Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 6' 5" o/c         |          |
| Bottom Edge (Lu) | 6' 5" o/c         |          |

•Maximum allowable bracing intervals based on applied load.

| Vertical Load     | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|-------------------|-----------------|---------|-------------|-------------------|----------|
| 1 - Uniform (PSF) | 0 to 6' 7"      | 16"     | 15.0        | 40.0              | Floor    |

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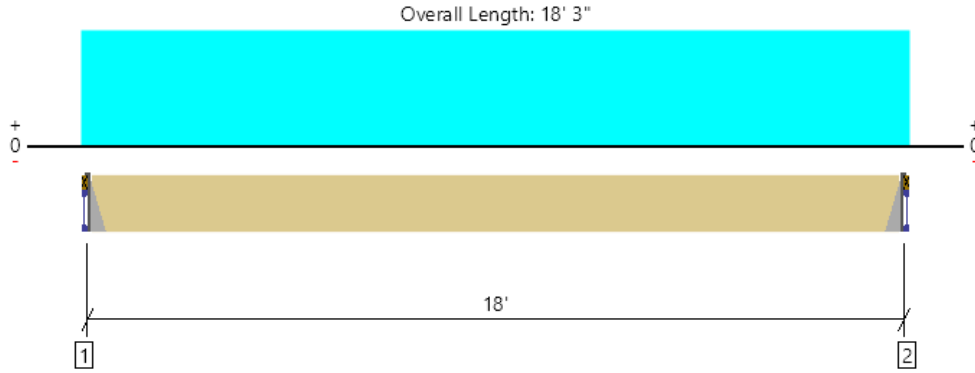
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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

| ForteWEB Software Operator  | Job Notes |
|---|-----------|
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Upper Floor, Rev 1 UJ5 - Master Floor Joist, 18'-0"  
1 piece(s) 2 x 12 HF No.2 @ 12" 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) | 495 @ 1' 1/2"     | 911 (1.50") | Passed (54%)   | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 443 @ 1' 3/4"     | 1688        | Passed (26%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 2228 @ 9' 1 1/2"  | 2577        | Passed (86%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.408 @ 9' 1 1/2" | 0.450       | Passed (L/529) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.561 @ 9' 1 1/2" | 0.900       | Passed (L/385) | --   | 1.0 D + 1.0 L (All Spans)   |
| TJ-Pro™ 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.

| Supports                         | Bearing Length |                     |          | Loads to Supports (lbs) |            |          | Accessories           |
|----------------------------------|----------------|---------------------|----------|-------------------------|------------|----------|-----------------------|
|                                  | Total          | Available           | Required | Dead                    | Floor Live | Factored |                       |
| 1 - Hanger on Single 2X HF plate | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 137                     | 365        | 502      | See note <sup>1</sup> |
| 2 - Hanger on Single 2X HF plate | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 137                     | 365        | 502      | See note <sup>1</sup> |

- 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)    | 4' 1" o/c         |          |
| Bottom Edge (Lu) | 18' o/c           |          |

- Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie |                     |             |               |                |                  |             |  |
|-------------------------------|---------------------|-------------|---------------|----------------|------------------|-------------|--|
| Support                       | Model               | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |  |
| 1 - Top Mount Hanger          | Connector not found | N/A         | N/A           | N/A            | N/A              |             |  |
| 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.

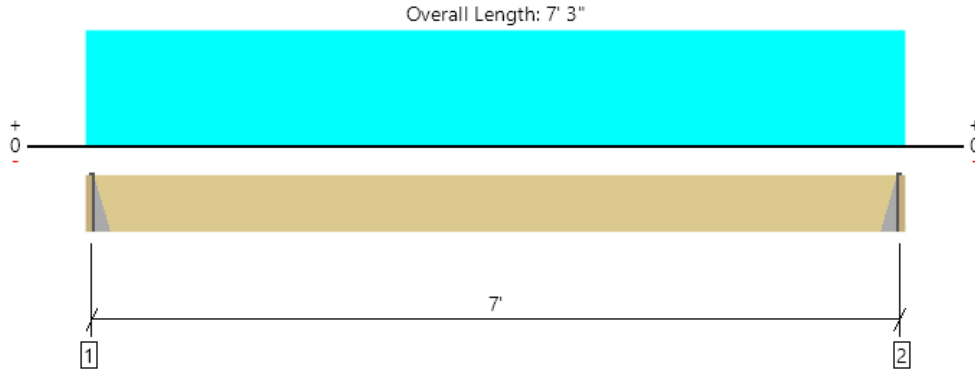
| Vertical Load     | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|-------------------|-----------------|---------|-------------|-------------------|----------|
| 1 - Uniform (PSF) | 0 to 18' 3"     | 12"     | 15.0        | 40.0              | Floor    |

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| ForteWEB Software Operator  | Job Notes |
|---|-----------|
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Upper Floor, Rev 1 UJ8 - Landing Floor Joist, 7'-0"  
1 piece(s) 2 x 6 HF No.2 @ 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) | 257 @ 1 1/2"      | 911 (1.50") | Passed (28%)   | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 223 @ 7"          | 825         | Passed (27%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 449 @ 3' 7 1/2"   | 801         | Passed (56%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.107 @ 3' 7 1/2" | 0.175       | Passed (L/788) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.147 @ 3' 7 1/2" | 0.350       | Passed (L/573) | --   | 1.0 D + 1.0 L (All Spans)   |
| TJ-Pro™ 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.

| Supports                     | Bearing Length |                     |          | Loads to Supports (lbs) |            |          | Accessories           |
|------------------------------|----------------|---------------------|----------|-------------------------|------------|----------|-----------------------|
|                              | Total          | Available           | Required | Dead                    | Floor Live | Factored |                       |
| 1 - Hanger on 5 1/2" HF beam | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 73                      | 193        | 266      | See note <sup>1</sup> |
| 2 - Hanger on 5 1/2" HF beam | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 73                      | 193        | 266      | See note <sup>1</sup> |

- 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)    | 7' o/c            |          |
| Bottom Edge (Lu) | 7' o/c            |          |

- Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie |       |             |               |                |                  |             |  |
|-------------------------------|-------|-------------|---------------|----------------|------------------|-------------|--|
| Support                       | Model | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |  |
| 1 - Top Mount Hanger          | THA29 | 2.25"       | 4-10d         | 6-10d          | 4-10d            |             |  |
| 2 - Top Mount Hanger          | THA29 | 2.25"       | 4-10d         | 6-10d          | 4-10d            |             |  |

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

| Vertical Load     | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|-------------------|-----------------|---------|-------------|-------------------|----------|
| 1 - Uniform (PSF) | 0 to 7' 3"      | 16"     | 15.0        | 40.0              | Floor    |

**Weyerhaeuser Notes**

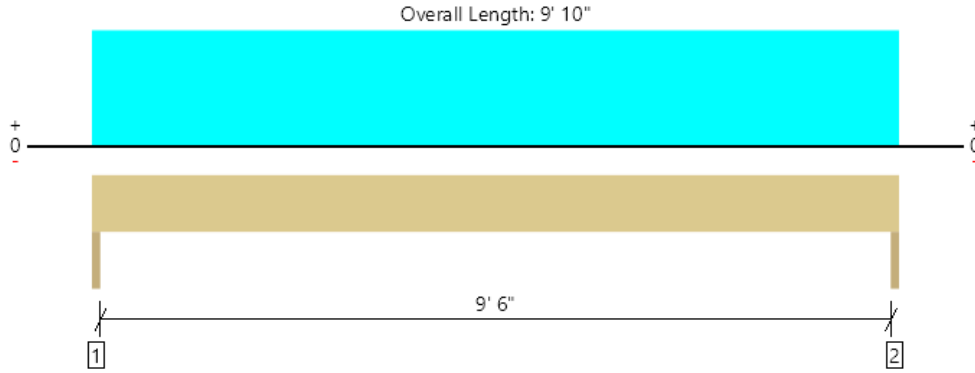
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| ForteWEB Software Operator  | Job Notes |
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Upper Floor, Rev 1 UB1 - Garage Door Header, 9'-6"  
 1 piece(s) 5 1/8" x 10 1/2" 24F-V4 DF Glulam



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) | 6399 @ 1/2"       | 6663 (2.00") | Passed (96%)    | --   | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Shear (lbs)           | 4966 @ 1' 1/2"    | 9507         | Passed (52%)    | 1.00 | 1.0 D + 1.0 L (All Spans)           |
| Pos Moment (Ft-lbs)   | 15229 @ 4' 11"    | 18834        | Passed (81%)    | 1.00 | 1.0 D + 1.0 L (All Spans)           |
| Live Load Defl. (in)  | 0.110 @ 4' 11"    | 0.325        | Passed (L/999+) | --   | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Total Load Defl. (in) | 0.297 @ 4' 11"    | 0.488        | Passed (L/393)  | --   | 1.0 D + 0.75 L + 0.75 S (All 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).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 9' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports         | Bearing Length |           |          | Loads to Supports (lbs) |            |      |          | Accessories |
|------------------|----------------|-----------|----------|-------------------------|------------|------|----------|-------------|
|                  | Total          | Available | Required | Dead                    | Floor Live | Snow | Factored |             |
| 1 - Trimmer - HF | 2.00"          | 2.00"     | 1.92"    | 4039                    | 2262       | 885  | 6399     | None        |
| 2 - Trimmer - HF | 2.00"          | 2.00"     | 1.92"    | 4039                    | 2262       | 885  | 6399     | None        |

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

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads        | Location (Side)   | Tributary Width | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments       |
|-----------------------|-------------------|-----------------|-------------|-------------------|-------------|----------------|
| 0 - Self Weight (PLF) | 0 to 9' 10"       | N/A             | 13.1        | --                | --          |                |
| 1 - Uniform (PSF)     | 0 to 9' 10" (Top) | 11' 6"          | 15.0        | 40.0              | -           | Floor          |
| 2 - Uniform (PSF)     | 0 to 9' 10" (Top) | 6'              | 18.0        | -                 | 30.0        | Roof           |
| 3 - Uniform (PLF)     | 0 to 9' 10" (Top) | N/A             | 528.0       | -                 | -           | Wall w/ Veneer |

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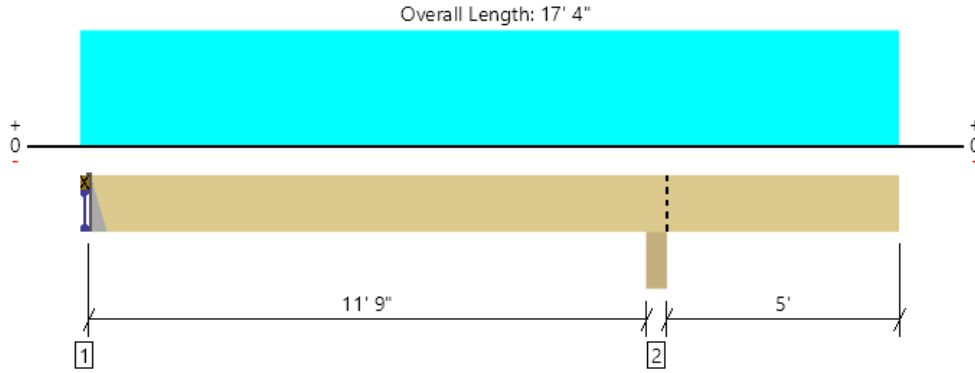
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|   |           |
|---|-----------|
| ForteWEB Software Operator  | Job Notes |
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Upper Floor, Rev 1 UB3 - Flush Beam at Shower, 11'-9"  
 1 piece(s) 1 3/4" x 11 7/8" 1.55E TimberStrand® LSL



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) | 811 @ 2"          | 2363 (1.50") | Passed (34%)    | --   | 1.0 D + 1.0 L (Alt Spans)   |
| Shear (lbs)           | 852 @ 10' 11 1/8" | 4295         | Passed (20%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 2284 @ 5' 9 9/16" | 7977         | Passed (29%)    | 1.00 | 1.0 D + 1.0 L (Alt Spans)   |
| Live Load Defl. (in)  | 0.180 @ 17' 4"    | 0.260        | Passed (2L/694) | --   | 1.0 D + 1.0 L (Alt Spans)   |
| Total Load Defl. (in) | 0.185 @ 17' 4"    | 0.521        | Passed (2L/676) | --   | 1.0 D + 1.0 L (Alt 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).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

| Supports                         | Bearing Length |                     |          | Loads to Supports (lbs) |            |          | Accessories           |
|----------------------------------|----------------|---------------------|----------|-------------------------|------------|----------|-----------------------|
|                                  | Total          | Available           | Required | Dead                    | Floor Live | Factored |                       |
| 1 - Hanger on Single 2X HF plate | 2.00"          | Hanger <sup>1</sup> | 1.50"    | 219                     | 615/-97    | 834      | See note <sup>1</sup> |
| 2 - Beam - GLB                   | 5.00"          | 5.00"               | 1.56"    | 542                     | 1232       | 1774     | 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.

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 16' 3" o/c        |          |
| Bottom Edge (Lu) | 17' 2" o/c        |          |

- Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie |                     |             |               |                |                  |             |  |
|-------------------------------|---------------------|-------------|---------------|----------------|------------------|-------------|--|
| Support                       | Model               | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |  |
| 1 - 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.

| Vertical Loads        | Location (Side)     | Tributary Width | Dead (0.90) | Floor Live (1.00) | Comments |
|-----------------------|---------------------|-----------------|-------------|-------------------|----------|
| 0 - Self Weight (PLF) | 2" to 17' 4"        | N/A             | 6.5         | --                |          |
| 1 - Uniform (PSF)     | 0 to 17' 4" (Front) | 2' 6"           | 15.0        | 40.0              | Floor    |

**Weyerhaeuser Notes**

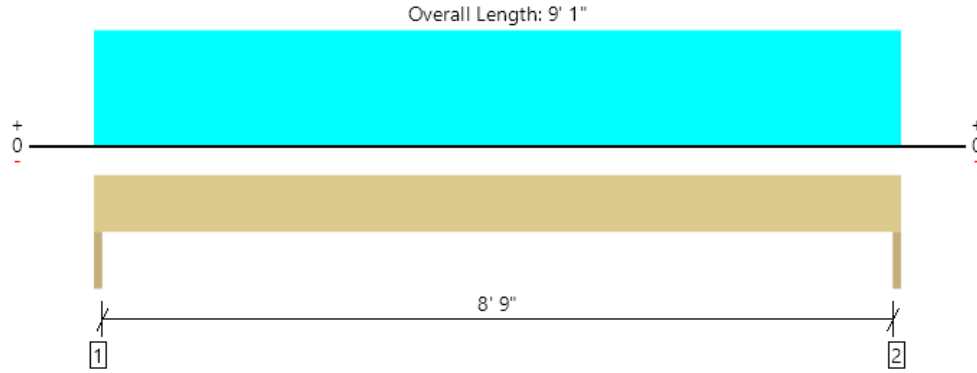
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Upper Floor, Rev 1 UB4 - Garage Window Header, 9'-6"  
1 piece(s) 5 1/8" x 9" 24F-V4 DF Glulam



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) | 4973 @ 1/2"       | 6663 (2.00") | Passed (75%)    | --   | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Shear (lbs)           | 3675 @ 11"        | 8149         | Passed (45%)    | 1.00 | 1.0 D + 1.0 L (All Spans)           |
| Pos Moment (Ft-lbs)   | 10264 @ 4' 6 1/2" | 13838        | Passed (74%)    | 1.00 | 1.0 D + 1.0 L (All Spans)           |
| Live Load Defl. (in)  | 0.090 @ 4' 6 1/2" | 0.300        | Passed (L/999+) | --   | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Total Load Defl. (in) | 0.288 @ 4' 6 1/2" | 0.450        | Passed (L/374)  | --   | 1.0 D + 0.75 L + 0.75 S (All 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).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 9'.
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports         | Bearing Length |           |          | Loads to Supports (lbs) |            |      |          | Accessories |
|------------------|----------------|-----------|----------|-------------------------|------------|------|----------|-------------|
|                  | Total          | Available | Required | Dead                    | Floor Live | Snow | Factored |             |
| 1 - Trimmer - HF | 2.00"          | 2.00"     | 1.50"    | 3423                    | 1181       | 886  | 4973     | None        |
| 2 - Trimmer - HF | 2.00"          | 2.00"     | 1.50"    | 3423                    | 1181       | 886  | 4973     | None        |

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

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads        | Location (Side)  | Tributary Width | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments       |
|-----------------------|------------------|-----------------|-------------|-------------------|-------------|----------------|
| 0 - Self Weight (PLF) | 0 to 9' 1"       | N/A             | 11.2        | --                | --          |                |
| 1 - Uniform (PSF)     | 0 to 9' 1" (Top) | 6' 6"           | 15.0        | 40.0              | -           | Floor          |
| 2 - Uniform (PSF)     | 0 to 9' 1" (Top) | 6' 6"           | 18.0        | -                 | 30.0        | Roof           |
| 3 - Uniform (PLF)     | 0 to 9' 1" (Top) | N/A             | 528.0       | -                 | -           | Wall w/ Veneer |

**Weyerhaeuser Notes**

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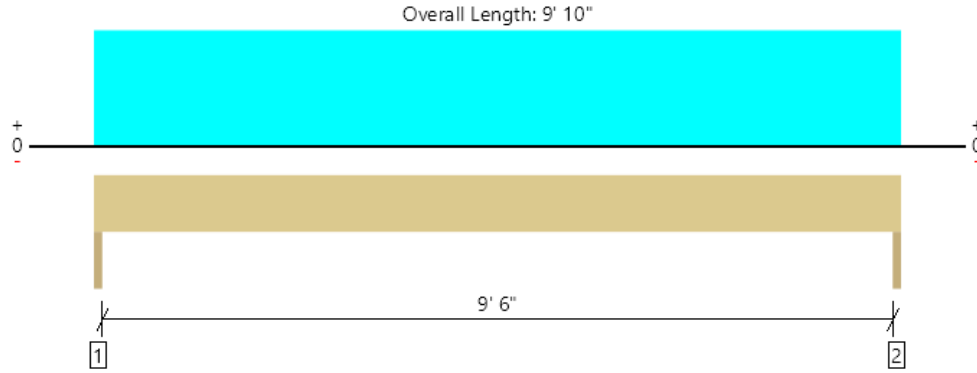
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

|   |           |
|---|-----------|
| ForteWEB Software Operator  | Job Notes |
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |





Upper Floor, Rev 1 UB5 - Beam over Pantry, 15'-0"  
 1 piece(s) 3 1/8" x 18" 24F-V4 DF Glulam



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) | 3853 @ 1/2"       | 4063 (2.00") | Passed (95%)    | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 2547 @ 1' 8"      | 9938         | Passed (26%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Pos Moment (Ft-lbs)   | 9312 @ 4' 11"     | 33750        | Passed (28%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.042 @ 4' 11"    | 0.325        | Passed (L/999+) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.058 @ 4' 11"    | 0.488        | Passed (L/999+) | --   | 1.0 D + 1.0 L (All 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).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 1.00 that was calculated using length L = 9' 9".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports         | Bearing Length |           |          | Loads to Supports (lbs) |            |          | Accessories |
|------------------|----------------|-----------|----------|-------------------------|------------|----------|-------------|
|                  | Total          | Available | Required | Dead                    | Floor Live | Factored |             |
| 1 - Trimmer - HF | 2.00"          | 2.00"     | 1.90"    | 1100                    | 2753       | 3853     | None        |
| 2 - Trimmer - HF | 2.00"          | 2.00"     | 1.90"    | 1100                    | 2753       | 3853     | None        |

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

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads        | Location (Side)   | Tributary Width | Dead (0.90) | Floor Live (1.00) | Comments |
|-----------------------|-------------------|-----------------|-------------|-------------------|----------|
| 0 - Self Weight (PLF) | 0 to 9' 10"       | N/A             | 13.7        | --                |          |
| 1 - Uniform (PSF)     | 0 to 9' 10" (Top) | 14'             | 15.0        | 40.0              | Floor    |

**Weyerhaeuser Notes**

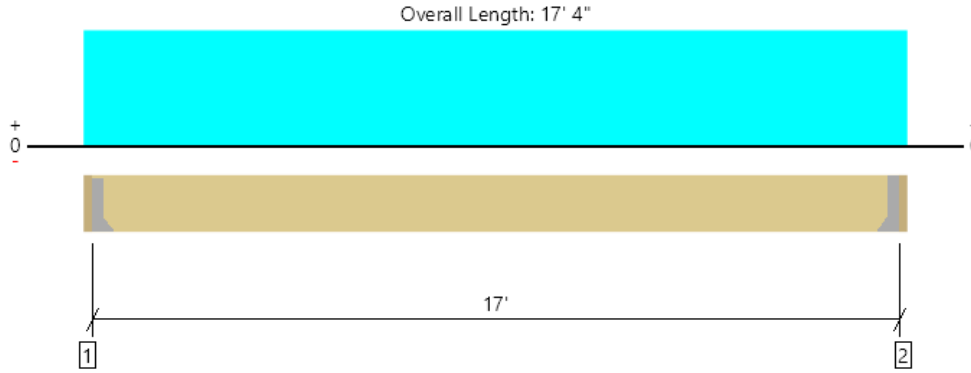
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|   |           |
|---|-----------|
| ForteWEB Software Operator  | Job Notes |
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Upper Floor, Rev 1 UB7 - Flush Header at Master Window, 17'-0"  
3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL



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) | 3502 @ 2"         | 5906 (1.50") | Passed (59%)   | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 3116 @ 1' 1 1/4"  | 11222        | Passed (28%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 14883 @ 8' 8"     | 24206        | Passed (61%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.363 @ 8' 8"     | 0.425        | Passed (L/562) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.650 @ 8' 8"     | 0.850        | Passed (L/314) | --   | 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).
- Allowed moment does not reflect the adjustment for the beam stability factor.

| Supports                       | Bearing Length |                     |          | Loads to Supports (lbs) |            |          | Accessories           |
|--------------------------------|----------------|---------------------|----------|-------------------------|------------|----------|-----------------------|
|                                | Total          | Available           | Required | Dead                    | Floor Live | Factored |                       |
| 1 - Hanger on 11 1/4" GLB beam | 2.00"          | Hanger <sup>1</sup> | 1.50"    | 1574                    | 1993       | 3568     | See note <sup>1</sup> |
| 2 - Hanger on 11 1/4" GLB beam | 2.00"          | Hanger <sup>1</sup> | 1.50"    | 1574                    | 1993       | 3568     | See note <sup>1</sup> |

- 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)    | 17' o/c           |          |
| Bottom Edge (Lu) | 17' o/c           |          |

•Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie |             |             |               |                |                  |             |
|-------------------------------|-------------|-------------|---------------|----------------|------------------|-------------|
| Support                       | Model       | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
| 1 - Face Mount Hanger         | HHUS5.50/10 | 3.00"       | N/A           | 30-10d         | 10-10d           |             |
| 2 - Face Mount Hanger         | HHUS5.50/10 | 3.00"       | N/A           | 30-10d         | 10-10d           |             |

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

| Vertical Loads        | Location (Side)   | Tributary Width | Dead (0.90) | Floor Live (1.00) | Comments |
|-----------------------|-------------------|-----------------|-------------|-------------------|----------|
| 0 - Self Weight (PLF) | 2" to 17' 2"      | N/A             | 17.2        | --                |          |
| 1 - Uniform (PSF)     | 0 to 17' 4" (Top) | 1' 3"           | 15.0        | 40.0              | Floor    |
| 2 - Uniform (PSF)     | 0 to 17' 4" (Top) | 3'              | 22.0        | 60.0              | Deck     |
| 3 - Uniform (PLF)     | 0 to 17' 4" (Top) | N/A             | 80.0        | -                 | Glazing  |

**Weyerhaeuser Notes**

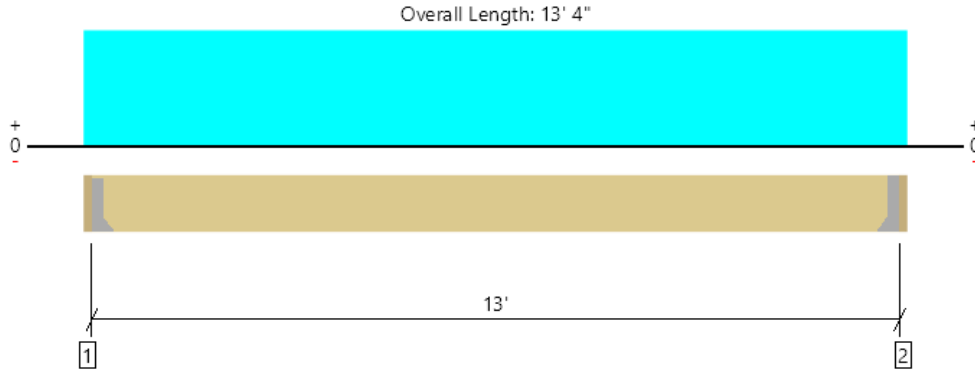
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|   |           |
|---|-----------|
| ForteWEB Software Operator  | Job Notes |
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Upper Floor, Rev 1 UB7b - Flush Header at Master Window, 13'-0"  
3 piece(s) 1 3/4" x 11 1/4" 2.0E Microllam® LVL



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) | 1612 @ 2"         | 5906 (1.50") | Passed (27%)    | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 1379 @ 1' 1 1/4"  | 11222        | Passed (12%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 5239 @ 6' 8"      | 24206        | Passed (22%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.061 @ 6' 8"     | 0.325        | Passed (L/999+) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.138 @ 6' 8"     | 0.650        | Passed (L/999+) | --   | 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).
- Allowed moment does not reflect the adjustment for the beam stability factor.

| Supports                       | Bearing Length |                     |          | Loads to Supports (lbs) |            |          | Accessories           |
|--------------------------------|----------------|---------------------|----------|-------------------------|------------|----------|-----------------------|
|                                | Total          | Available           | Required | Dead                    | Floor Live | Factored |                       |
| 1 - Hanger on 11 1/4" GLB beam | 2.00"          | Hanger <sup>1</sup> | 1.50"    | 917                     | 733        | 1650     | See note <sup>1</sup> |
| 2 - Hanger on 11 1/4" GLB beam | 2.00"          | Hanger <sup>1</sup> | 1.50"    | 917                     | 733        | 1650     | See note <sup>1</sup> |

- 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)    | 13' o/c           |          |
| Bottom Edge (Lu) | 13' o/c           |          |

•Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie |             |             |               |                |                  |             |
|-------------------------------|-------------|-------------|---------------|----------------|------------------|-------------|
| Support                       | Model       | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
| 1 - Face Mount Hanger         | HHUS5.50/10 | 3.00"       | N/A           | 30-10d         | 10-10d           |             |
| 2 - Face Mount Hanger         | HHUS5.50/10 | 3.00"       | N/A           | 30-10d         | 10-10d           |             |

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

| Vertical Loads        | Location (Side)   | Tributary Width | Dead (0.90) | Floor Live (1.00) | Comments |
|-----------------------|-------------------|-----------------|-------------|-------------------|----------|
| 0 - Self Weight (PLF) | 2" to 13' 2"      | N/A             | 17.2        | --                |          |
| 1 - Uniform (PSF)     | 0 to 13' 4" (Top) | 1' 3"           | 15.0        | 40.0              | Floor    |
| 2 - Uniform (PSF)     | 0 to 13' 4" (Top) | 1'              | 22.0        | 60.0              | Deck     |
| 3 - Uniform (PLF)     | 0 to 13' 4" (Top) | N/A             | 80.0        | -                 | Glazing  |

**Weyerhaeuser Notes**

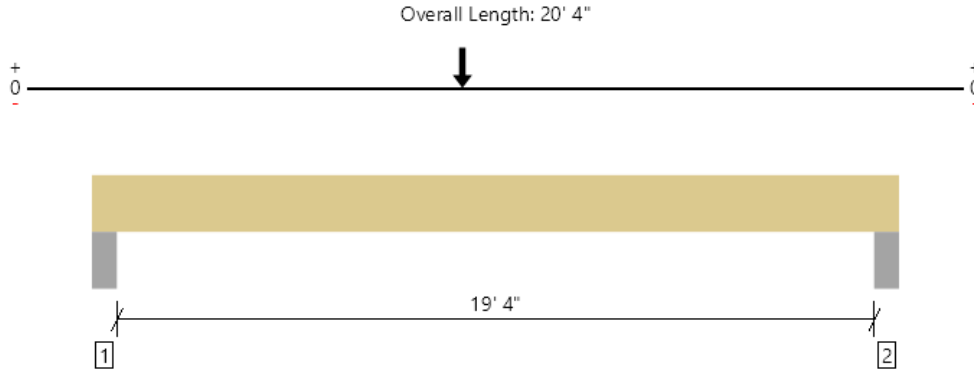
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| ForteWEB Software Operator  | Job Notes |
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Upper Floor, Rev 1 UB13 - Flush Beam over Dining, 19'-4"  
1 piece(s) 5 1/8" x 22 1/2" 24F-V4 DF Glulam



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) | 9036 @ 4 1/2"       | 19988 (6.00") | Passed (45%)   | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 8970 @ 2' 4 1/2"    | 20372         | Passed (44%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Pos Moment (Ft-lbs)   | 79732 @ 9' 4"       | 81784         | Passed (97%)   | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.302 @ 9' 11 1/4"  | 0.490         | Passed (L/779) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.504 @ 9' 11 5/16" | 0.979         | Passed (L/466) | --   | 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).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume/size factor of 0.95 that was calculated using length L = 19' 7".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

| Supports           | Bearing Length |           |          | Loads to Supports (lbs) |            |          | Accessories |
|--------------------|----------------|-----------|----------|-------------------------|------------|----------|-------------|
|                    | Total          | Available | Required | Dead                    | Floor Live | Factored |             |
| 1 - Column - steel | 6.00"          | 6.00"     | 2.71"    | 3681                    | 5355       | 9036     | None        |
| 2 - Column - steel | 6.00"          | 6.00"     | 2.30"    | 3149                    | 4515       | 7664     | None        |

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 7' 10" o/c        |          |
| Bottom Edge (Lu) | 20' 4" o/c        |          |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads        | Location (Side) | Tributary Width | Dead (0.90) | Floor Live (1.00) | Comments |
|-----------------------|-----------------|-----------------|-------------|-------------------|----------|
| 0 - Self Weight (PLF) | 0 to 20' 4"     | N/A             | 28.0        | --                |          |
| 1 - Point (lb)        | 9' 4" (Front)   | N/A             | 6260        | 9870              | UB6 Beam |

**Weyerhaeuser Notes**

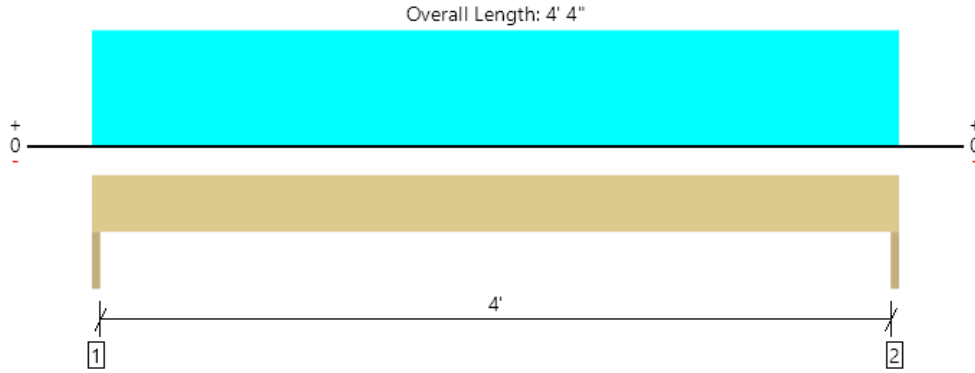
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|---|-----------|
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Upper Floor, Rev 1 UB14 - Utility Room Header, 5'-6"  
2 piece(s) 2 x 10 HF No.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) | 1356 @ 1/2"       | 2430 (2.00") | Passed (56%)    | --   | 1.0 D + 1.0 L (All Spans)   |
| Shear (lbs)           | 769 @ 11 1/4"     | 2775         | Passed (28%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Moment (Ft-lbs)       | 1413 @ 2' 2"      | 3333         | Passed (42%)    | 1.00 | 1.0 D + 1.0 L (All Spans)   |
| Live Load Defl. (in)  | 0.013 @ 2' 2"     | 0.142        | Passed (L/999+) | --   | 1.0 D + 1.0 L (All Spans)   |
| Total Load Defl. (in) | 0.018 @ 2' 2"     | 0.213        | Passed (L/999+) | --   | 1.0 D + 1.0 L (All 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).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

| Supports         | Bearing Length |           |          | Loads to Supports (lbs) |            |          | Accessories |
|------------------|----------------|-----------|----------|-------------------------|------------|----------|-------------|
|                  | Total          | Available | Required | Dead                    | Floor Live | Factored |             |
| 1 - Trimmer - HF | 2.00"          | 2.00"     | 1.50"    | 381                     | 975        | 1356     | None        |
| 2 - Trimmer - HF | 2.00"          | 2.00"     | 1.50"    | 381                     | 975        | 1356     | None        |

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 4' 4" o/c         |          |
| Bottom Edge (Lu) | 4' 4" o/c         |          |

•Maximum allowable bracing intervals based on applied load.

| Vertical Loads        | Location (Side)  | Tributary Width | Dead (0.90) | Floor Live (1.00) | Comments |
|-----------------------|------------------|-----------------|-------------|-------------------|----------|
| 0 - Self Weight (PLF) | 0 to 4' 4"       | N/A             | 7.0         | --                |          |
| 1 - Uniform (PSF)     | 0 to 4' 4" (Top) | 11' 3"          | 15.0        | 40.0              | Floor    |

**Weyerhaeuser Notes**

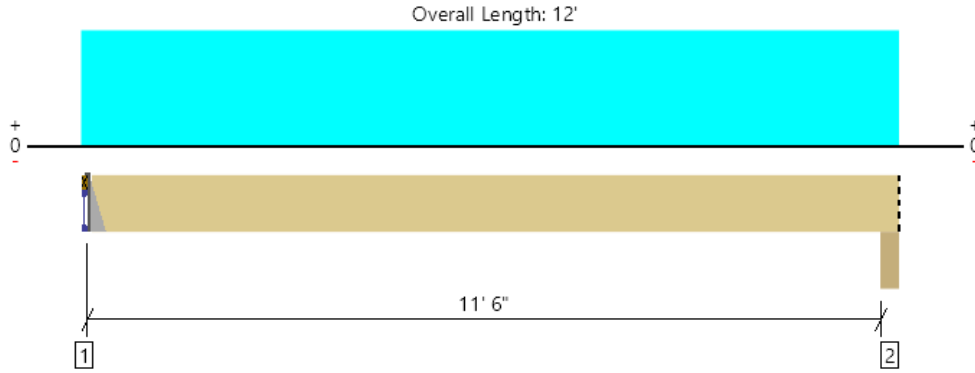
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|---|-----------|
| ForteWEB Software Operator  | Job Notes |
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



Upper Floor, Rev 1 UB15 - Flush Beam over Entry, 11'-6"  
 1 piece(s) 3 1/2" x 11 7/8" 1.55E TimberStrand® LSL



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) | 3671 @ 1' 1/2"     | 4725 (1.50") | Passed (78%)    | --   | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Shear (lbs)           | 2720 @ 1' 1 3/8"   | 7731         | Passed (35%)    | 0.90 | 1.0 D (All Spans)                   |
| Moment (Ft-lbs)       | 9527 @ 5' 11 1/4"  | 14358        | Passed (66%)    | 0.90 | 1.0 D (All Spans)                   |
| Live Load Defl. (in)  | 0.041 @ 5' 11 1/4" | 0.291        | Passed (L/999+) | --   | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Total Load Defl. (in) | 0.381 @ 5' 11 1/4" | 0.581        | Passed (L/366)  | --   | 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).
- Allowed moment does not reflect the adjustment for the beam stability factor.

| Supports                         | Bearing Length |                     |          | Loads to Supports (lbs) |            |      |          | Accessories           |
|----------------------------------|----------------|---------------------|----------|-------------------------|------------|------|----------|-----------------------|
|                                  | Total          | Available           | Required | Dead                    | Floor Live | Snow | Factored |                       |
| 1 - Hanger on Single 2X HF plate | 1.50"          | Hanger <sup>1</sup> | 1.50"    | 3347                    | 238        | 297  | 3748     | See note <sup>1</sup> |
| 2 - Beam - HF                    | 4.50"          | 4.50"               | 2.70"    | 3419                    | 243        | 303  | 3828     | 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.

| Lateral Bracing  | Bracing Intervals | Comments |
|------------------|-------------------|----------|
| Top Edge (Lu)    | 11' 11" o/c       |          |
| Bottom Edge (Lu) | 11' 11" o/c       |          |

•Maximum allowable bracing intervals based on applied load.

| Connector: Simpson Strong-Tie |                     |             |               |                |                  |             |
|-------------------------------|---------------------|-------------|---------------|----------------|------------------|-------------|
| Support                       | Model               | Seat Length | Top Fasteners | Face Fasteners | Member Fasteners | Accessories |
| 1 - 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.

| Vertical Loads        | Location (Side)  | Tributary Width | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments       |
|-----------------------|------------------|-----------------|-------------|-------------------|-------------|----------------|
| 0 - Self Weight (PLF) | 1 1/2" to 12'    | N/A             | 13.0        | --                | --          |                |
| 1 - Uniform (PSF)     | 0 to 12' (Front) | 1'              | 15.0        | 40.0              | -           | Floor          |
| 2 - Uniform (PSF)     | 0 to 12' (Top)   | 2'              | 18.0        | -                 | 25.0        | Roof           |
| 3 - Uniform (PLF)     | 0 to 12' (Top)   | N/A             | 500.0       | -                 | -           | Wall w/ veneer |

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

|   |           |
|---|-----------|
| ForteWEB Software Operator  | Job Notes |
| Maxwell Skotheim<br>Quantum Consulting Engineers<br>(206) 957-3906<br>MSkotheim@quantumce.com |           |



## Steel Beam

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

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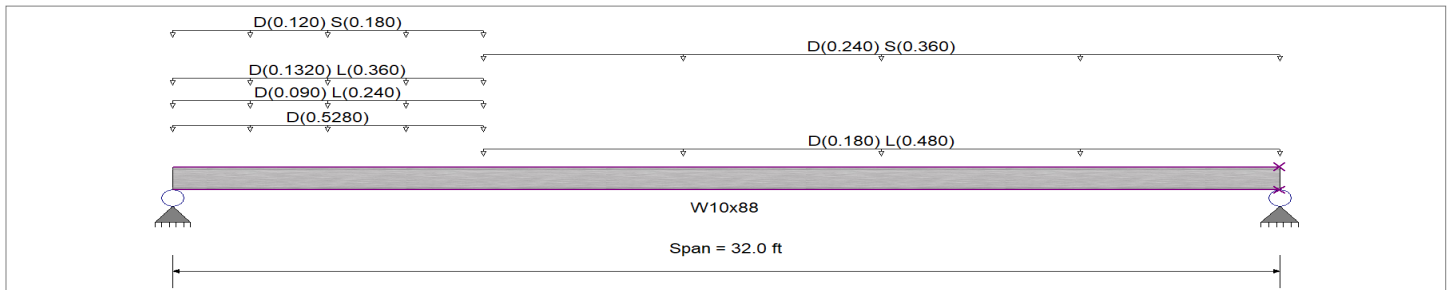
**DESCRIPTION:** Rev 1 - Upper Floor UB2a - Floor Steel Beam over Garage, 32'-0"

## CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

## Material Properties

Analysis Method : Allowable Strength Design  
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling  
 Bending Axis : Major Axis Bending  
 Fy : Steel Yield : 50.0 ksi  
 E : Modulus : 29,000.0 ksi



## Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight calculated and added to loading  
 Load for Span Number 1

Uniform Load : D = 0.0150, L = 0.040 ksf, Extent = 9.0 -->> 32.0 ft, Tributary Width = 12.0 ft, (Floor)

Uniform Load : D = 0.0480 ksf, Extent = 0.0 -->> 9.0 ft, Tributary Width = 11.0 ft, (Wall w/ veneer)

Uniform Load : D = 0.0150, L = 0.040 ksf, Extent = 0.0 -->> 9.0 ft, Tributary Width = 6.0 ft, (Floor)

Uniform Load : D = 0.0220, L = 0.060 ksf, Extent = 0.0 -->> 9.0 ft, Tributary Width = 6.0 ft, (Roof Deck)

Uniform Load : D = 0.020, S = 0.030 ksf, Extent = 9.0 -->> 32.0 ft, Tributary Width = 12.0 ft, (Roof)

Uniform Load : D = 0.020, S = 0.030 ksf, Extent = 0.0 -->> 9.0 ft, Tributary Width = 6.0 ft, (Roof)

## DESIGN SUMMARY

**Design OK**

|                                   |                  |                              |                            |
|-----------------------------------|------------------|------------------------------|----------------------------|
| Maximum Bending Stress Ratio =    | <b>0.546</b> : 1 | Maximum Shear Stress Ratio = | <b>0.163</b> : 1           |
| Section used for this span        | <b>W10x88</b>    | Section used for this span   | <b>W10x88</b>              |
| Ma : Applied                      | 153.981 k-ft     | Va : Applied                 | 21.340 k                   |
| Mn / Omega : Allowable            | 281.936 k-ft     | Vn/Omega : Allowable         | 130.680 k                  |
| Load Combination                  | +D+0.750L+0.750S | Load Combination             | +D+0.750L+0.750S           |
| Span # where maximum occurs       | Span # 1         | Location of maximum on span  | 0.000 ft                   |
|                                   |                  | Span # where maximum occurs  | Span # 1                   |
| <b>Maximum Deflection</b>         |                  |                              |                            |
| Max Downward Transient Deflection | 0.767 in Ratio = | <b>500</b> >=240.            | Span: 1 : L Only           |
| Max Upward Transient Deflection   | 0 in Ratio =     | <b>0</b> <240.0              | n/a                        |
| Max Downward Total Deflection     | 1.853 in Ratio = | <b>207</b> >=180             | Span: 1 : +D+0.750L+0.750S |
| Max Upward Total Deflection       | 0 in Ratio =     | <b>0</b> <180                | n/a                        |

## Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios |       | Summary of Moment Values |        |        |        |           | Summary of Shear Values |      |        |               |        |
|------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|-------------------------|------|--------|---------------|--------|
|                  |                |        | M                 | V     | Mmax +                   | Mmax - | Ma Max | Mnx    | Mnx/Omega | Cb                      | Rm   | Va Max | Vnx/Vnx/Omega |        |
| D Only           |                |        |                   |       |                          |        |        |        |           |                         |      |        |               |        |
| Dsgn. L =        | 32.00 ft       | 1      | 0.264             | 0.089 | 74.46                    |        | 74.46  | 470.83 | 281.94    | 1.00                    | 1.00 | 11.61  | 196.02        | 130.68 |
| +D+L             |                |        |                   |       |                          |        |        |        |           |                         |      |        |               |        |
| Dsgn. L =        | 32.00 ft       | 1      | 0.490             | 0.155 | 138.27                   |        | 138.27 | 470.83 | 281.94    | 1.00                    | 1.00 | 20.22  | 196.02        | 130.68 |
| +D+S             |                |        |                   |       |                          |        |        |        |           |                         |      |        |               |        |
| Dsgn. L =        | 32.00 ft       | 1      | 0.414             | 0.122 | 116.64                   |        | 116.64 | 470.83 | 281.94    | 1.00                    | 1.00 | 15.98  | 196.02        | 130.68 |
| +D+0.750L        |                |        |                   |       |                          |        |        |        |           |                         |      |        |               |        |
| Dsgn. L =        | 32.00 ft       | 1      | 0.434             | 0.138 | 122.31                   |        | 122.31 | 470.83 | 281.94    | 1.00                    | 1.00 | 18.06  | 196.02        | 130.68 |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

## Steel Beam

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

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**DESCRIPTION:** Rev 1 - Upper Floor UB2a - Floor Steel Beam over Garage, 32'-0"

### Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios |       | Summary of Moment Values |        |        |        |              | Summary of Shear Values |        |               |        |        |
|------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|--------------|-------------------------|--------|---------------|--------|--------|
|                  |                |        | M                 | V     | Mmax +                   | Mmax - | Ma Max | Mnx    | Mnx/Omega Cb | Rm                      | Va Max | Vnx/Vnx/Omega |        |        |
| +D+0.750L+0.750S |                |        |                   |       |                          |        |        |        |              |                         |        |               |        |        |
| Dsgn. L =        | 32.00 ft       | 1      | 0.546             | 0.163 | 153.98                   |        | 153.98 | 470.83 | 281.94       | 1.00                    | 1.00   | 21.34         | 196.02 | 130.68 |
| +0.60D           |                |        |                   |       |                          |        |        |        |              |                         |        |               |        |        |
| Dsgn. L =        | 32.00 ft       | 1      | 0.158             | 0.053 | 44.67                    |        | 44.67  | 470.83 | 281.94       | 1.00                    | 1.00   | 6.97          | 196.02 | 130.68 |

### Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+0.750L+0.750S | 1    | 1.8534        | 15.909           |                  | 0.0000        | 0.000            |

### Vertical Reactions

| Load Combination                            | Support notation : Far left is # |           |       | Values in KIPS |
|---|----------------------------------|-----------|-------|----------------|
|   | Support 1                        | Support 2 |       |                |
| Max Upward from all Load Conditions         | 21.340                           | 18.721    | 8.722 |                |
| Max Upward from Load Combinations           | 21.340                           | 18.721    | 8.722 |                |
| Max Upward from Load Cases                  | 11.608                           | 8.698     | 8.722 |                |
| Max Downward from all Load Conditions (Resi |                                  |           | 8.722 |                |
| Max Downward from Load Combinations (Resi   |                                  |           | 8.722 |                |
| Max Downward from Load Cases (Resisting U   |                                  |           | 8.722 |                |
| D Only                                      | 11.608                           | 8.698     | 8.722 |                |
| +D+L  | 20.217                           | 16.529    | 8.722 |                |
| +D+S  | 15.976                           | 14.230    | 8.722 |                |
| +D+0.750L                                   | 18.065                           | 14.571    | 8.722 |                |
| +D+0.750L+0.750S                            | 21.340                           | 18.721    | 8.722 |                |
| +0.60D                                      | 6.965                            | 5.219     | 8.722 |                |
| L Only                                      | 8.608                            | 7.832     | 8.722 |                |
| S Only                                      | 4.368                            | 5.532     | 8.722 |                |



## Wood Beam

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

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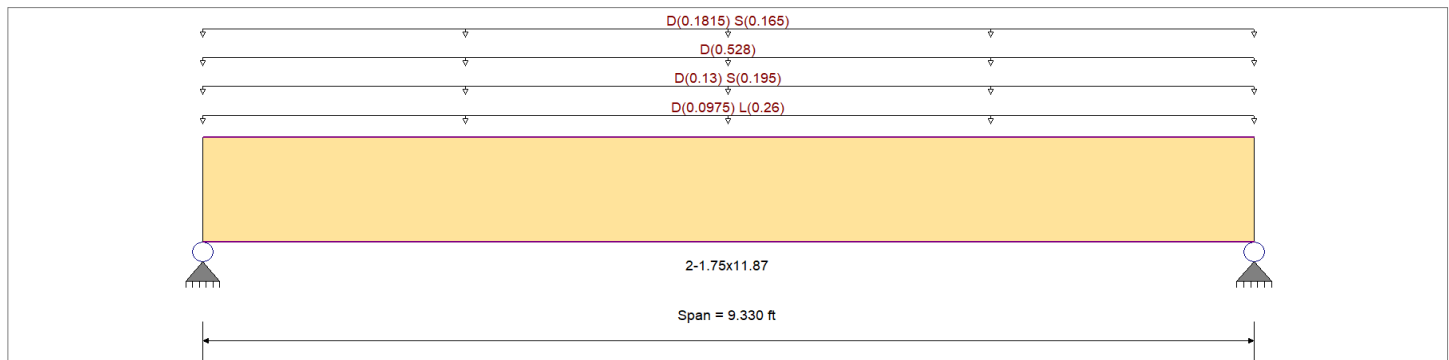
**DESCRIPTION:** Rev 1 - Upper Floor UB2b - Floor Beam over Utility, 9'-4"

### CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

### Material Properties

|  |           |             |                           |
|--|-----------|-------------|---------------------------|
| Analysis Method : Allowable Stress Design                              | Fb +      | 2,600.0 psi | E : Modulus of Elasticity |
| Load Combination IBC 2018  | Fb -      | 2,600.0 psi | Ebend- xx                 |
|  | Fc - Prll | 2,510.0 psi | Eminbend - xx             |
| Wood Species : iLevel Truss Joist                                      | Fc - Perp | 750.0 psi   |                           |
| Wood Grade : MicroLam LVL 1.9 E  | Fv        | 285.0 psi   |                           |
|  | Ft        | 1,555.0 psi | Density                   |
| Beam Bracing : Beam is Fully Braced against lateral-torsional buckling |           |             | 42.010pcf                 |



### Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight calculated and added to loading

- Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 6.50 ft, (Floor)
- Uniform Load : D = 0.020, S = 0.030 ksf, Tributary Width = 6.50 ft, (Roof)
- Uniform Load : D = 0.0480 ksf, Tributary Width = 11.0 ft, (Wall w/ veneer)
- Uniform Load : D = 0.0330, S = 0.030 ksf, Tributary Width = 5.50 ft, (Roof Deck)

### DESIGN SUMMARY

**Design OK**

|                                     |   |                     |                                   |                            |                     |
|-------------------------------------|---|---------------------|-----------------------------------|----------------------------|---------------------|
| <b>Maximum Bending Stress Ratio</b> | = | <b>0.750</b> : 1    | <b>Maximum Shear Stress Ratio</b> | =                          | <b>0.573</b> : 1    |
| Section used for this span          |   | <b>2-1.75x11.87</b> | Section used for this span        |                            | <b>2-1.75x11.87</b> |
| fb: Actual                          | = | 2,244.70 psi        | fv: Actual                        | =                          | 187.69 psi          |
| F'b                                 | = | 2,994.26 psi        | F'v                               | =                          | 327.75 psi          |
| Load Combination                    |   | +D+0.750L+0.750S    | Load Combination                  |                            | +D+0.750L+0.750S    |
| Location of maximum on span         | = | 4.665ft             | Location of maximum on span       | =                          | 8.343 ft            |
| Span # where maximum occurs         | = | Span # 1            | Span # where maximum occurs       | =                          | Span # 1            |
| <b>Maximum Deflection</b>           |   |                     |                                   |                            |                     |
| Max Downward Transient Deflection   |   | 0.067 in Ratio =    | 1682 >=360                        | Span: 1 : S Only           |                     |
| Max Upward Transient Deflection     |   | 0 in Ratio =        | 0 <360                            | n/a                        |                     |
| Max Downward Total Deflection       |   | 0.261 in Ratio =    | 428 >=180                         | Span: 1 : +D+0.750L+0.750S |                     |
| Max Upward Total Deflection         |   | 0 in Ratio =        | 0 <180                            | n/a                        |                     |

### Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length    | Span # | Max Stress Ratios |       |      |      |                |      |                |                 |                |                | Moment Values |         |         | Shear Values |      |     |     |     |       |
|------------------|-------------------|--------|-------------------|-------|------|------|----------------|------|----------------|-----------------|----------------|----------------|---------------|---------|---------|--------------|------|-----|-----|-----|-------|
|                  |                   |        | M                 | V     | CD   | CM   | C <sub>t</sub> | CLx  | C <sub>F</sub> | C <sub>fu</sub> | C <sub>i</sub> | C <sub>r</sub> | M             | fb      | F'b     | V            | fv   | F'v |     |     |       |
| D Only           |                   |        |                   |       |      |      |                |      |                |                 |                |                |               |         |         |              |      |     |     |     |       |
|                  | Length = 9.330 ft | 1      | 0.643             | 0.491 | 0.90 | 1.00 | 1.00           | 1.00 | 1.001          | 1.00            | 1.00           | 1.00           | 10.33         | 1,506.6 | 2,343.3 | 0.0          | 0.00 | 0.0 | 0.0 | 0.0 | 256.5 |
| +D+L             |                   |        |                   |       |      |      |                |      |                |                 |                |                |               |         |         |              |      |     |     |     |       |
|                  | Length = 9.330 ft | 1      | 0.737             | 0.563 | 1.00 | 1.00 | 1.00           | 1.00 | 1.001          | 1.00            | 1.00           | 1.00           | 13.16         | 1,919.3 | 2,603.7 | 0.0          | 0.00 | 0.0 | 0.0 | 0.0 | 285.0 |
| +D+S             |                   |        |                   |       |      |      |                |      |                |                 |                |                |               |         |         |              |      |     |     |     |       |
|                  | Length = 9.330 ft | 1      | 0.694             | 0.530 | 1.15 | 1.00 | 1.00           | 1.00 | 1.001          | 1.00            | 1.00           | 1.00           | 14.24         | 2,078.0 | 2,994.3 | 0.0          | 0.00 | 0.0 | 0.0 | 0.0 | 327.8 |
| +D+0.750L        |                   |        |                   |       |      |      |                |      |                |                 |                |                |               |         |         |              |      |     |     |     |       |
|                  | Length = 9.330 ft | 1      | 0.558             | 0.426 | 1.25 | 1.00 | 1.00           | 1.00 | 1.001          | 1.00            | 1.00           | 1.00           | 12.45         | 1,816.1 | 3,254.6 | 0.0          | 0.00 | 0.0 | 0.0 | 0.0 | 356.3 |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Wood Beam**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION:** Rev 1 - Upper Floor UB2b - Floor Beam over Utility, 9'-4"

**Maximum Forces & Stresses for Load Combinations**

| Load Combination  | Segment Length | Span # | Max Stress Ratios |      |      |      |                |       |                |                 |                |                | Moment Values |         |      | Shear Values |       |     |
|-------------------|----------------|--------|-------------------|------|------|------|----------------|-------|----------------|-----------------|----------------|----------------|---------------|---------|------|--------------|-------|-----|
|                   |                |        | M                 | V    | CD   | CM   | C <sub>t</sub> | CLx   | C <sub>F</sub> | C <sub>fu</sub> | C <sub>i</sub> | C <sub>r</sub> | M             | fb      | F'b  | V            | fv    | F'v |
| +D+0.750L+0.750S  |                |        |                   |      |      | 1.00 | 1.00           | 1.00  | 1.001          | 1.00            | 1.00           | 1.00           |               |         | 0.0  | 0.00         | 0.0   | 0.0 |
| Length = 9.330 ft | 1              | 0.750  | 0.573             | 1.15 | 1.00 | 1.00 | 1.00           | 1.001 | 1.00           | 1.00            | 1.00           | 15.39          | 2,244.7       | 2,994.3 | 5.20 | 187.7        | 327.8 |     |
| +0.60D            |                |        |                   |      | 1.00 | 1.00 | 1.00           | 1.001 | 1.00           | 1.00            | 1.00           |                |               | 0.0     | 0.00 | 0.0          | 0.0   |     |
| Length = 9.330 ft | 1              | 0.217  | 0.166             | 1.60 | 1.00 | 1.00 | 1.00           | 1.001 | 1.00           | 1.00            | 1.00           | 6.20           | 904.0         | 4,165.9 | 2.09 | 75.6         | 456.0 |     |

**Overall Maximum Deflections**

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+0.750L+0.750S | 1    | 0.2613        | 4.699            |                  | 0.0000        | 0.000            |

**Vertical Reactions**

Support notation : Far left is #1

Values in KIPS

| Load Combination                    | Support 1 | Support 2 |
|-------------------------------------|-----------|-----------|
| Max Upward from all Load Conditions | 6.597     | 6.597     |
| Max Upward from Load Combinations   | 6.597     | 6.597     |
| Max Upward from Load Cases          | 4.428     | 4.428     |
| D Only                              | 4.428     | 4.428     |
| +D+L                                | 5.641     | 5.641     |
| +D+S                                | 6.107     | 6.107     |
| +D+0.750L                           | 5.337     | 5.337     |
| +D+0.750L+0.750S                    | 6.597     | 6.597     |
| +0.60D                              | 2.657     | 2.657     |
| L Only                              | 1.213     | 1.213     |
| S Only                              | 1.679     | 1.679     |

## Steel Beam

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION:** Rev 1 - Upper Floor UB6 - Floor Steel Beam, 30'-9"

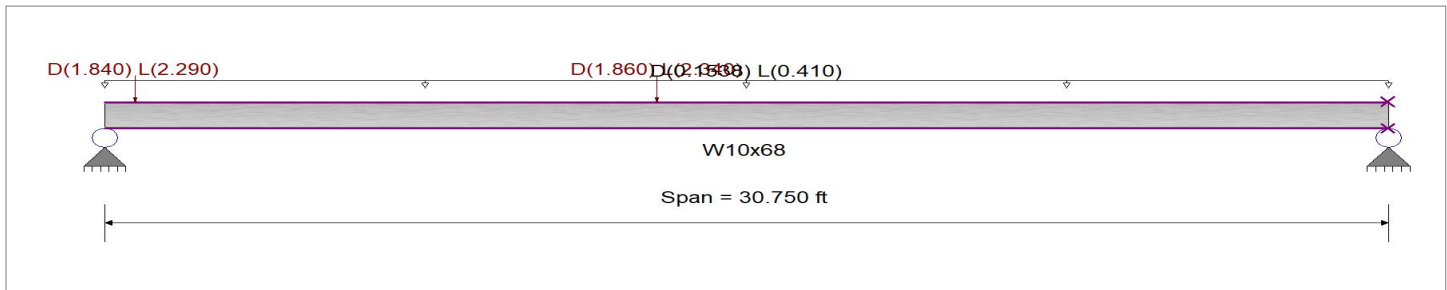
## CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

## Material Properties

Analysis Method : Allowable Strength Design  
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling  
 Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi  
 E: Modulus : 29,000.0 ksi



## Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight calculated and added to loading  
 Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 10.250 ft, (Floor)

Point Load : D = 1.840, L = 2.290 k @ 0.750 ft, (Deck Beam UB10b)

Point Load : D = 1.860, L = 2.340 k @ 13.250 ft, (Deck Beam UB10)

## DESIGN SUMMARY

**Design OK**

|                                   |                  |                              |                  |
|-----------------------------------|------------------|------------------------------|------------------|
| Maximum Bending Stress Ratio =    | <b>0.501</b> : 1 | Maximum Shear Stress Ratio = | <b>0.165</b> : 1 |
| Section used for this span        | <b>W10x68</b>    | Section used for this span   | <b>W10x68</b>    |
| Ma : Applied                      | 106.668 k-ft     | Va : Applied                 | 16.133 k         |
| Mn / Omega : Allowable            | 212.824 k-ft     | Vn/Omega : Allowable         | 97.760 k         |
| Load Combination                  | +D+L             | Load Combination             | +D+L             |
| Span # where maximum occurs       | Span # 1         | Location of maximum on span  | 0.000 ft         |
|                                   |                  | Span # where maximum occurs  | Span # 1         |
| <b>Maximum Deflection</b>         |                  |                              |                  |
| Max Downward Transient Deflection | 0.949 in Ratio = | <b>388</b> >=360.            | Span: 1 : L Only |
| Max Upward Transient Deflection   | 0 in Ratio =     | <b>0</b> <360.0              | n/a              |
| Max Downward Total Deflection     | 1.522 in Ratio = | <b>243</b> >=240.            | Span: 1 : +D+L   |
| Max Upward Total Deflection       | 0 in Ratio =     | <b>0</b> <240.0              | n/a              |

## Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios |       | Summary of Moment Values |        |        |        |           | Summary of Shear Values |      |        |        |           |
|------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|-------------------------|------|--------|--------|-----------|
|                  |                |        | M                 | V     | Mmax +                   | Mmax - | Ma Max | Mnx    | Mnx/Omega | Cb                      | Rm   | Va Max | Vnx    | Vnx/Omega |
| D Only           |                |        |                   |       |                          |        |        |        |           |                         |      |        |        |           |
| Dsgn. L =        | 30.75 ft       | 1      | 0.190             | 0.064 | 40.51                    |        | 40.51  | 355.42 | 212.82    | 1.00                    | 1.00 | 6.26   | 146.64 | 97.76     |
| +D+L             |                |        |                   |       |                          |        |        |        |           |                         |      |        |        |           |
| Dsgn. L =        | 30.75 ft       | 1      | 0.501             | 0.165 | 106.67                   |        | 106.67 | 355.42 | 212.82    | 1.00                    | 1.00 | 16.13  | 146.64 | 97.76     |
| +D+0.750L        |                |        |                   |       |                          |        |        |        |           |                         |      |        |        |           |
| Dsgn. L =        | 30.75 ft       | 1      | 0.423             | 0.140 | 90.13                    |        | 90.13  | 355.42 | 212.82    | 1.00                    | 1.00 | 13.67  | 146.64 | 97.76     |
| +0.60D           |                |        |                   |       |                          |        |        |        |           |                         |      |        |        |           |
| Dsgn. L =        | 30.75 ft       | 1      | 0.114             | 0.038 | 24.31                    |        | 24.31  | 355.42 | 212.82    | 1.00                    | 1.00 | 3.76   | 146.64 | 97.76     |

## Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+L             | 1    | 1.5216        | 15.199           |                  | 0.0000        | 0.000            |

## Vertical Reactions

Support notation : Far left is #

Values in KIPS

| Load Combination                    | Support 1 | Support 2 |
|-------------------------------------|-----------|-----------|
| Max Upward from all Load Conditions | 16.133    | 11.624    |
| Max Upward from Load Combinations   | 16.133    | 11.624    |

Project Title:  
Engineer:  
Project ID:  
Project Descr:

## Steel Beam

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION:** Rev 1 - Upper Floor UB6 - Floor Steel Beam, 30'-9"

### Vertical Reactions

Support notation : Far left is #

Values in KIPS

| Load Combination                            | Support 1 | Support 2 |       |
|---|-----------|-----------|-------|
| Max Upward from Load Cases                  | 9.870     | 7.368     | 8.722 |
| Max Downward from all Load Conditions (Resi |           |           | 8.722 |
| Max Downward from Load Combinations (Resi   |           |           | 8.722 |
| Max Downward from Load Cases (Resisting U   |           |           | 8.722 |
| D Only                                      | 6.263     | 4.256     | 8.722 |
| +D+L  | 16.133    | 11.624    | 8.722 |
| +D+0.750L                                   | 13.665    | 9.782     | 8.722 |
| +0.60D                                      | 3.758     | 2.553     | 8.722 |
| L Only                                      | 9.870     | 7.368     | 8.722 |

## Steel Beam

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION:** Rev 1 - Upper Floor UB10 - Cantilever Deck Beam, 7'-0" Cant.

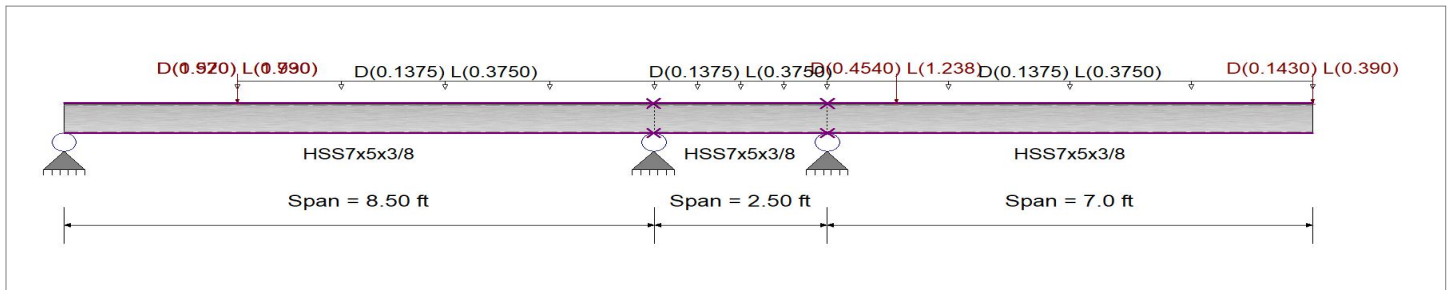
## CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

## Material Properties

Analysis Method : Allowable Strength Design  
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling  
 Bending Axis : Major Axis Bending

Fy : Steel Yield : 46.0 ksi  
 E: Modulus : 29,000.0 ksi



## Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight calculated and added to loading

Load for Span Number 1

Uniform Load : D = 0.0220, L = 0.060 ksf, Extent = 2.50 --> 8.50 ft, Tributary Width = 6.250 ft, (Deck)

Point Load : D = 0.920, L = 0.730 k @ 2.50 ft, (Flush Beam UB7b)

Point Load : D = 1.570, L = 1.990 k @ 2.50 ft, (Flush Beam UB7)

Load for Span Number 2

Uniform Load : D = 0.0220, L = 0.060 ksf, Tributary Width = 6.250 ft, (Deck)

Load for Span Number 3

Uniform Load : D = 0.0220, L = 0.060 ksf, Tributary Width = 6.250 ft, (Deck)

Point Load : D = 0.4540, L = 1.238 k @ 1.0 ft, (Flush Rim Beam)

Point Load : D = 0.1430, L = 0.390 k @ 7.0 ft, (Flush Rim Beam)

## DESIGN SUMMARY

**Design OK**

|                                   |                   |                              |                                      |
|-----------------------------------|-------------------|------------------------------|--------------------------------------|
| Maximum Bending Stress Ratio =    | <b>0.464</b> : 1  | Maximum Shear Stress Ratio = | <b>0.087</b> : 1                     |
| Section used for this span        | <b>HSS7x5x3/8</b> | Section used for this span   | <b>HSS7x5x3/8</b>                    |
| Ma : Applied                      | 18.653 k-ft       | Va : Applied                 | 6.005 k                              |
| Mn / Omega : Allowable            | 40.170 k-ft       | Vn/Omega : Allowable         | 68.673 k                             |
| Load Combination                  | +D+L              | Load Combination             | +D+L                                 |
| Span # where maximum occurs       | Span # 2          | Location of maximum on span  | 0.000 ft                             |
|                                   |                   | Span # where maximum occurs  | Span # 3                             |
| <b>Maximum Deflection</b>         |                   |                              |                                      |
| Max Downward Transient Deflection | 0.295 in          | Ratio =                      | <b>570</b> >=360. Span: 3 : L Only   |
| Max Upward Transient Deflection   | -0.008 in         | Ratio =                      | <b>3,947</b> >=360. Span: 3 : L Only |
| Max Downward Total Deflection     | 0.422 in          | Ratio =                      | <b>398</b> >=240. Span: 3 : +D+L     |
| Max Upward Total Deflection       | -0.011 in         | Ratio =                      | <b>2641</b> >=240. Span: 3 : +D+L    |

## Maximum Forces & Stresses for Load Combinations

| Load Combination  | Segment Length | Span # | Max Stress Ratios |       | Summary of Moment Values |        |        |       |           | Summary of Shear Values |      |        |        |           |
|-------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|-------|-----------|-------------------------|------|--------|--------|-----------|
|                   |                |        | M                 | V     | Mmax +                   | Mmax - | Ma Max | Mnx   | Mnx/Omega | Cb                      | Rm   | Va Max | Vnx    | Vnx/Omega |
| D Only            |                |        |                   |       |                          |        |        |       |           |                         |      |        |        |           |
| Dsgn. L = 8.50 ft |                | 1      | 0.113             | 0.027 | 4.55                     | -2.59  | 4.55   | 67.08 | 40.17     | 1.00                    | 1.00 | 1.86   | 114.68 | 68.67     |
| Dsgn. L = 2.50 ft |                | 2      | 0.137             | 0.015 | -0.00                    | -5.50  | 5.50   | 67.08 | 40.17     | 1.00                    | 1.00 | 1.75   | 199.34 | 119.37    |
| Dsgn. L = 7.00 ft |                | 3      | 0.137             | 0.026 |                          | -5.50  | 5.50   | 67.08 | 40.17     | 1.00                    | 1.00 | 1.75   | 114.68 | 68.67     |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Steel Beam**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION:** Rev 1 - Upper Floor UB10 - Cantilever Deck Beam, 7'-0" Cant.

**Maximum Forces & Stresses for Load Combinations**

| Load Combination | Segment Length | Span # | Max Stress Ratios |       | Summary of Moment Values |        |        |       |              | Summary of Shear Values |        |               |        |        |
|------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|-------|--------------|-------------------------|--------|---------------|--------|--------|
|                  |                |        | M                 | V     | Mmax +                   | Mmax - | Ma Max | Mnx   | Mnx/Omega Cb | Rm                      | Va Max | Vnx/Vnx/Omega |        |        |
| <b>+D+L</b>      |                |        |                   |       |                          |        |        |       |              |                         |        |               |        |        |
| Dsgn. L =        | 8.50 ft        | 1      | 0.259             | 0.065 | 10.39                    | -5.75  | 10.39  | 67.08 | 40.17        | 1.00                    | 1.00   | 4.49          | 114.68 | 68.67  |
| Dsgn. L =        | 2.50 ft        | 2      | 0.464             | 0.050 | -0.00                    | -18.65 | 18.65  | 67.08 | 40.17        | 1.00                    | 1.00   | 6.00          | 199.34 | 119.37 |
| Dsgn. L =        | 7.00 ft        | 3      | 0.464             | 0.087 |                          | -18.65 | 18.65  | 67.08 | 40.17        | 1.00                    | 1.00   | 6.00          | 114.68 | 68.67  |
| <b>+D+0.750L</b> |                |        |                   |       |                          |        |        |       |              |                         |        |               |        |        |
| Dsgn. L =        | 8.50 ft        | 1      | 0.222             | 0.053 | 8.93                     | -4.96  | 8.93   | 67.08 | 40.17        | 1.00                    | 1.00   | 3.66          | 114.68 | 68.67  |
| Dsgn. L =        | 2.50 ft        | 2      | 0.382             | 0.041 | -0.00                    | -15.36 | 15.36  | 67.08 | 40.17        | 1.00                    | 1.00   | 4.94          | 199.34 | 119.37 |
| Dsgn. L =        | 7.00 ft        | 3      | 0.382             | 0.072 |                          | -15.36 | 15.36  | 67.08 | 40.17        | 1.00                    | 1.00   | 4.94          | 114.68 | 68.67  |
| <b>+0.60D</b>    |                |        |                   |       |                          |        |        |       |              |                         |        |               |        |        |
| Dsgn. L =        | 8.50 ft        | 1      | 0.068             | 0.016 | 2.73                     | -1.56  | 2.73   | 67.08 | 40.17        | 1.00                    | 1.00   | 1.12          | 114.68 | 68.67  |
| Dsgn. L =        | 2.50 ft        | 2      | 0.082             | 0.009 | -0.00                    | -3.30  | 3.30   | 67.08 | 40.17        | 1.00                    | 1.00   | 1.05          | 199.34 | 119.37 |
| Dsgn. L =        | 7.00 ft        | 3      | 0.082             | 0.015 |                          | -3.30  | 3.30   | 67.08 | 40.17        | 1.00                    | 1.00   | 1.05          | 114.68 | 68.67  |

**Overall Maximum Deflections**

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+L             | 1    | 0.0698        | 3.740            |                  | 0.0000        | 0.000            |
|                  | 2    | 0.0000        | 3.740            | +D+L             | -0.0114       | 1.367            |
| +D+L             | 3    | 0.4222        | 7.000            |                  | 0.0000        | 1.367            |

**Vertical Reactions**

Support notation : Far left is #

Values in KIPS

| Load Combination                            | Support 1 | Support 2 | Support 3 | Support 4 |
|---|-----------|-----------|-----------|-----------|
| Max Upward from all Load Conditions         | 4.203     | 0.733     | 11.841    |           |
| Max Upward from Load Combinations           | 4.203     | 0.440     | 11.841    |           |
| Max Upward from Load Cases                  | 2.343     | 0.733     | 8.722     |           |
| Max Downward from all Load Conditions (Resi |           |           | -0.904    |           |
| Max Downward from Load Combinations (Resi   |           |           | -0.171    |           |
| Max Downward from Load Cases (Resisting U   |           |           | -0.904    |           |
| D Only                                      | 1.860     | 0.733     | 3.119     |           |
| +D+L  | 4.203     | -0.171    | 11.841    |           |
| +D+0.750L                                   | 3.618     | 0.055     | 9.661     |           |
| +0.60D                                      | 1.116     | 0.440     | 1.872     |           |
| L Only                                      | 2.343     | -0.904    | 8.722     |           |

## Steel Beam

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION:** Rev 1 - Upper Floor UB10b - Cantilever Deck Beam, 7'-0" Cant.

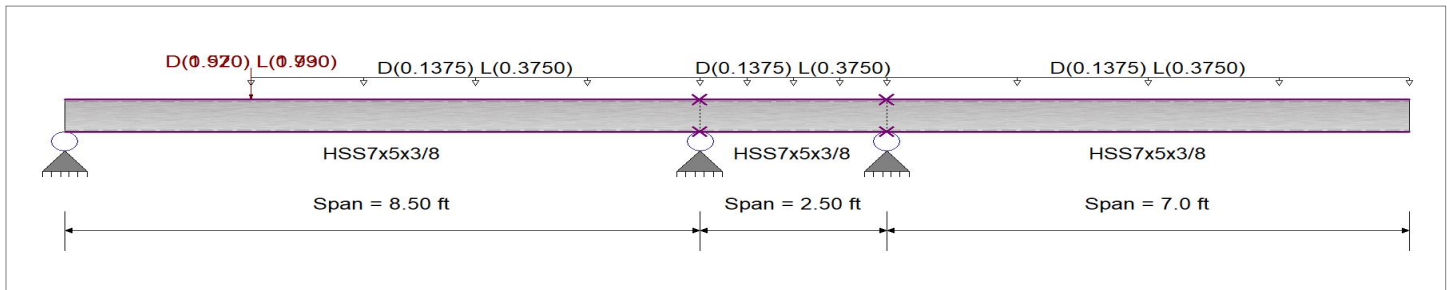
## CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16  
 Load Combination Set : IBC 2018

## Material Properties

Analysis Method : Allowable Strength Design  
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling  
 Bending Axis : Major Axis Bending

Fy : Steel Yield : 46.0 ksi  
 E: Modulus : 29,000.0 ksi



## Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight calculated and added to loading

Load for Span Number 1

Uniform Load : D = 0.0220, L = 0.060 ksf, Extent = 2.50 --> 8.50 ft, Tributary Width = 6.250 ft, (Deck)

Point Load : D = 0.920, L = 0.730 k @ 2.50 ft, (Flush Beam UB7b)

Point Load : D = 1.570, L = 1.990 k @ 2.50 ft, (Flush Beam UB7)

Load for Span Number 2

Uniform Load : D = 0.0220, L = 0.060 ksf, Tributary Width = 6.250 ft, (Deck)

Load for Span Number 3

Uniform Load : D = 0.0220, L = 0.060 ksf, Tributary Width = 6.250 ft, (Deck)

## DESIGN SUMMARY

**Design OK**

|                                   |                                       |                              |                   |
|-----------------------------------|---------------------------------------|------------------------------|-------------------|
| Maximum Bending Stress Ratio =    | <b>0.329</b> : 1                      | Maximum Shear Stress Ratio = | <b>0.064</b> : 1  |
| Section used for this span        | <b>HSS7x5x3/8</b>                     | Section used for this span   | <b>HSS7x5x3/8</b> |
| Ma : Applied                      | 13.230 k-ft                           | Va : Applied                 | 4.388 k           |
| Mn / Omega : Allowable            | 40.170 k-ft                           | Vn/Omega : Allowable         | 68.673 k          |
| Load Combination                  | +D+L                                  | Load Combination             | +D+L              |
| Span # where maximum occurs       | Span # 2                              | Location of maximum on span  | 8.500 ft          |
|                                   |                                       | Span # where maximum occurs  | Span # 1          |
| <b>Maximum Deflection</b>         |                                       |                              |                   |
| Max Downward Transient Deflection | 0.210 in Ratio = <b>800</b> >=360.    | Span: 3 : L Only             |                   |
| Max Upward Transient Deflection   | -0.006 in Ratio = <b>5,097</b> >=360. | Span: 3 : L Only             |                   |
| Max Downward Total Deflection     | 0.307 in Ratio = <b>548</b> >=240.    | Span: 3 : +D+L               |                   |
| Max Upward Total Deflection       | -0.009 in Ratio = <b>3325</b> >=240.  | Span: 3 : +D+L               |                   |

## Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios |       | Summary of Moment Values |        |        |       |           | Summary of Shear Values |      |        |               |        |
|------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|-------|-----------|-------------------------|------|--------|---------------|--------|
|                  |                |        | M                 | V     | Mmax +                   | Mmax - | Ma Max | Mnx   | Mnx/Omega | Cb                      | Rm   | Va Max | Vnx/Vnx/Omega |        |
| <b>D Only</b>    |                |        |                   |       |                          |        |        |       |           |                         |      |        |               |        |
| Dsgn. L =        | 8.50 ft        | 1      | 0.112             | 0.027 | 4.50                     | -2.76  | 4.50   | 67.08 | 40.17     | 1.00                    | 1.00 | 1.84   | 114.68        | 68.67  |
| Dsgn. L =        | 2.50 ft        | 2      | 0.101             | 0.010 | -0.00                    | -4.04  | 4.04   | 67.08 | 40.17     | 1.00                    | 1.00 | 1.15   | 199.34        | 119.37 |
| Dsgn. L =        | 7.00 ft        | 3      | 0.101             | 0.017 |                          | -4.04  | 4.04   | 67.08 | 40.17     | 1.00                    | 1.00 | 1.15   | 114.68        | 68.67  |
| <b>+D+L</b>      |                |        |                   |       |                          |        |        |       |           |                         |      |        |               |        |
| Dsgn. L =        | 8.50 ft        | 1      | 0.254             | 0.064 | 10.21                    | -6.37  | 10.21  | 67.08 | 40.17     | 1.00                    | 1.00 | 4.39   | 114.68        | 68.67  |
| Dsgn. L =        | 2.50 ft        | 2      | 0.329             | 0.032 | -0.00                    | -13.23 | 13.23  | 67.08 | 40.17     | 1.00                    | 1.00 | 3.78   | 199.34        | 119.37 |
| Dsgn. L =        | 7.00 ft        | 3      | 0.329             | 0.055 |                          | -13.23 | 13.23  | 67.08 | 40.17     | 1.00                    | 1.00 | 3.78   | 114.68        | 68.67  |
| <b>+D+0.750L</b> |                |        |                   |       |                          |        |        |       |           |                         |      |        |               |        |

Project Title:  
 Engineer:  
 Project ID:  
 Project Descr:

**Steel Beam**

Project File: Hong Kao - Rev 1.ec6

LIC# : KW-06016450, Build:20.23.07.20

QUANTUM CONSULTING ENGINEERS

(c) ENERCALC INC 1983-2023

**DESCRIPTION:** Rev 1 - Upper Floor UB10b - Cantilever Deck Beam, 7'-0" Cant.

**Maximum Forces & Stresses for Load Combinations**

| Load Combination | Segment Length | Span # | Max Stress Ratios |       | Summary of Moment Values |        |        |       |              | Summary of Shear Values |        |               |        |        |
|------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|-------|--------------|-------------------------|--------|---------------|--------|--------|
|                  |                |        | M                 | V     | Mmax +                   | Mmax - | Ma Max | Mnx   | Mnx/Omega Cb | Rm                      | Va Max | Vnx/Vnx/Omega |        |        |
| Dsgn. L =        | 8.50 ft        | 1      | 0.219             | 0.054 | 8.79                     | -5.46  | 8.79   | 67.08 | 40.17        | 1.00                    | 1.00   | 3.72          | 114.68 | 68.67  |
| Dsgn. L =        | 2.50 ft        | 2      | 0.272             | 0.026 | -0.00                    | -10.93 | 10.93  | 67.08 | 40.17        | 1.00                    | 1.00   | 3.12          | 199.34 | 119.37 |
| Dsgn. L =        | 7.00 ft        | 3      | 0.272             | 0.045 |                          | -10.93 | 10.93  | 67.08 | 40.17        | 1.00                    | 1.00   | 3.12          | 114.68 | 68.67  |
| <b>+0.60D</b>    |                |        |                   |       |                          |        |        |       |              |                         |        |               |        |        |
| Dsgn. L =        | 8.50 ft        | 1      | 0.067             | 0.016 | 2.70                     | -1.66  | 2.70   | 67.08 | 40.17        | 1.00                    | 1.00   | 1.10          | 114.68 | 68.67  |
| Dsgn. L =        | 2.50 ft        | 2      | 0.060             | 0.006 | -0.00                    | -2.43  | 2.43   | 67.08 | 40.17        | 1.00                    | 1.00   | 0.69          | 199.34 | 119.37 |
| Dsgn. L =        | 7.00 ft        | 3      | 0.060             | 0.010 |                          | -2.43  | 2.43   | 67.08 | 40.17        | 1.00                    | 1.00   | 0.69          | 114.68 | 68.67  |

**Overall Maximum Deflections**

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+L             | 1    | 0.0666        | 3.683            |                  | 0.0000        | 0.000            |
|                  | 2    | 0.0000        | 3.683            | +D+L             | -0.0090       | 1.333            |
| +D+L             | 3    | 0.3065        | 7.000            |                  | 0.0000        | 1.333            |

**Vertical Reactions**

Support notation : Far left is #

Values in KIPS

| Load Combination                    | Support 1 | Support 2 | Support 3 | Support 4 |
|-------------------------------------|-----------|-----------|-----------|-----------|
| Max Upward from all Load Conditions | 4.131     | 2.317     | 7.200     |           |
| Max Upward from Load Combinations   | 4.131     | 2.317     | 7.200     |           |
| Max Upward from Load Cases          | 2.290     | 1.401     | 5.326     |           |
| D Only                              | 1.841     | 1.401     | 1.874     |           |
| +D+L                                | 4.131     | 2.317     | 7.200     |           |
| +D+0.750L                           | 3.558     | 2.088     | 5.869     |           |
| +0.60D                              | 1.105     | 0.841     | 1.124     |           |
| L Only                              | 2.290     | 0.916     | 5.326     |           |





**HONG AND KAO RESIDENCE**

5425 W. Mercer Way  
Mercer Island, WA 98040

Quantum Job Number: 23127.01

# **LATERAL DESIGN – MAIN HOUSE**

# Shear Wall Loads

Structure: **Hong & Kao Residence - Main House**

### Seismic Loads:

Dead Load at Roof: **24 psf**  
 Roof Snow Load: **30 psf**  
 Seismic Snow Load: **0.0 psf**  
 Dead Load at Floor: **24 psf**  
 Load at Deck: **22 psf**  
 Veneer: **38 psf**

### Wind Loads:

Wall Load (E-W): **21.4 psf**  
 Wall Load (N-S): **20.4 psf**  
 Projected Roof Load: **8.0 psf**

$\rho$ : **1.3**  
 $C_{v,roof}$ : **0.253**  
 $C_{v,upper}$ : **0.166**  
 $C_{v,main}$ : **0.079**

### Basement Shear Walls:

| SW Grid<br>(N-S) | Seismic Tributary (sf) |        |      |        |      | EQ (lb) | Wind Tributary (sf) |           |       |
|------------------|------------------------|--------|------|--------|------|---------|---------------------|-----------|-------|
|                  | Roof                   | Floor  | Deck | Veneer | Wall |         | Roof                | Wind (lb) |       |
| <b>Grid 2</b>    | 521.5                  | 1017   | 510  | 405.25 | 0    | 15128   | 483                 | 0         | 9853  |
| <b>Grid 3</b>    | 2289.5                 | 3341.5 | 376  | 1315   | 0    | 47947   | 1279                | 0         | 26092 |
| <b>Grid 4</b>    | 1446                   | 1471.5 | 79   | 566.25 | 0    | 24054   | 380                 | 0         | 7752  |
| (E-W)            |                        |        |      |        |      |         |                     |           |       |
| <b>Grid A</b>    | 369                    | 334    | 0    | 114    | 0    | 3179    | 111                 | 0         | 2375  |
| <b>Grid B</b>    | 1007                   | 915    | 255  | 225    | 0    | 15744   | 301                 | 0         | 6441  |
| <b>Grid C</b>    | 1934                   | 1593   | 631  | 332    | 0    | 29235   | 754                 | 0         | 16136 |
| <b>Grid D</b>    | 0                      | 888    | 0    | 242    | 0    | 6584    | 382                 | 0         | 8175  |
| <b>Grid E</b>    | 1402                   | 1114   | 0    | 305    | 0    | 19338   | 397                 | 0         | 8496  |

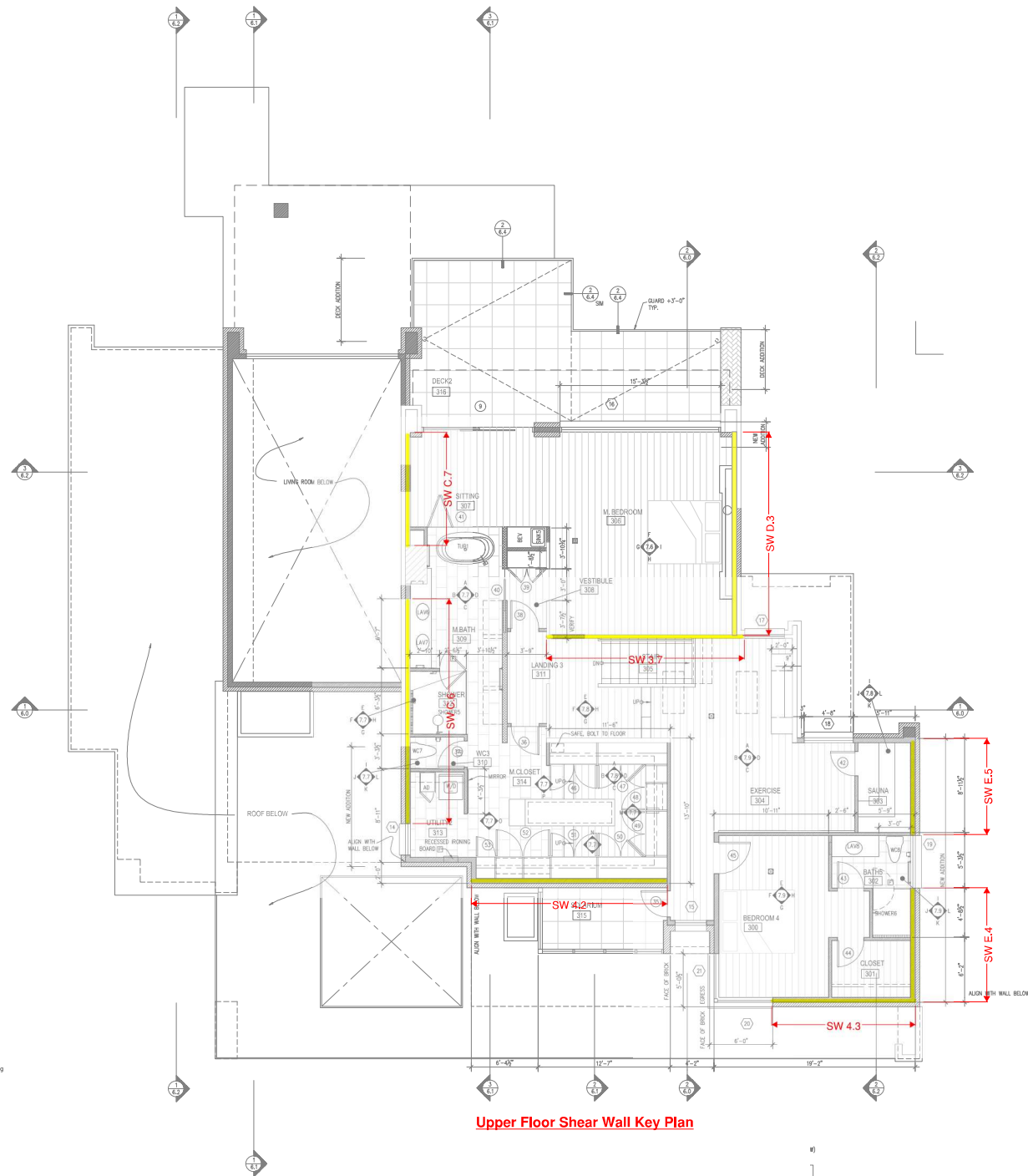
### Main Floor Shear Walls:

| SW Grid<br>(N-S) | Seismic Tributary (sf) |       |      |        |      | EQ (lb) | Wind Tributary (sf) |           |       |
|------------------|------------------------|-------|------|--------|------|---------|---------------------|-----------|-------|
|                  | Roof                   | Floor | Deck | Veneer | Wall |         | Roof                | Wind (lb) |       |
| <b>Grid 2</b>    | 521.5                  | 0     | 0    | 154.25 | 0    | 5381    | 306                 | 0         | 6242  |
| <b>Grid 3</b>    | 2185.5                 | 1415  | 376  | 1095   | 0    | 35345   | 751                 | 0         | 15320 |
| <b>Grid 4</b>    | 1446                   | 562   | 79   | 595.5  | 0    | 19583   | 256                 | 0         | 5222  |
| (E-W)            |                        |       |      |        |      |         |                     |           |       |
| <b>Grid A</b>    | 369                    | 0     | 0    | 74     | 0    | 2518    | 35                  | 0         | 749   |
| <b>Grid B</b>    | 1007                   | 0     | 0    | 177    | 0    | 9400    | 107                 | 0         | 2290  |
| <b>Grid C</b>    | 1934                   | 990   | 265  | 305    | 0    | 24153   | 451                 | 0         | 9651  |
| <b>Grid D</b>    | 527                    | 495   | 188  | 151    | 0    | 8854    | 126                 | 0         | 2696  |
| <b>Grid E</b>    | 770                    | 495   | 0    | 254    | 0    | 10725   | 325                 | 0         | 6955  |

**Upper Floor Shear Walls:**

| SW Grid<br>(N-S) | Seismic Tributary (sf) |       |      |        |         | Wind Tributary (sf) |      |           |
|------------------|------------------------|-------|------|--------|---------|---------------------|------|-----------|
|                  | Roof                   | Floor | Deck | Veneer | EQ (lb) | Wall                | Roof | Wind (lb) |
|                  |                        |       |      |        | 0       |                     |      | 0         |
|                  |                        |       |      |        | 0       |                     |      | 0         |
|                  |                        |       |      |        | 0       |                     |      | 0         |
| <b>Grid 3</b>    | 1332                   | 0     | 0    | 287.75 | 14111   | 177                 | 0    | 3611      |
|                  |                        |       |      |        | 0       |                     |      | 0         |
| <b>Grid 4</b>    | 773                    | 0     | 0    | 158.25 | 8080    | 66                  | 0    | 1346      |
| (E-W)            |                        |       |      |        |         |                     |      |           |
| <b>Grid C</b>    | 1053                   | 0     | 0    | 127    | 9899    | 145                 | 0    | 3103      |
|                  |                        |       |      |        | 0       |                     |      | 0         |
| <b>Grid D</b>    | 526                    | 0     | 0    | 64     | 4952    | 72                  | 0    | 1541      |
|                  |                        |       |      |        | 0       |                     |      | 0         |
|                  |                        |       |      |        | 0       |                     |      | 0         |
| <b>Grid E</b>    | 526                    | 0     | 0    | 64     | 4952    | 72                  | 0    | 1541      |





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**Upper Floor Shear Wall Key Plan**

VENT TO EXTERIOR  
 69 SQUARE FEET UNCONDITIONED SOLARIUM  
 229 SQUARE FEET EXISTING DECK  
 194 SQUARE FEET PROPOSED DECK

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **High Roof (N-S)**


Sds = 0.97  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

## Shear Wall Line Information

| SW Mark          | L <sub>sw</sub> (ft) | Wall Pier h <sub>wp</sub> (ft) | Aspect Ratio | Wall Framing Species | Specific Gravity G | Interstory or Base? | h <sub>sw</sub> (ft) | Wall Wt. (psf) | Roof/Floor Trib. (ft) | Roof/Floor Wt. (psf) |
|------------------|----------------------|--------------------------------|--------------|----------------------|--------------------|---------------------|----------------------|----------------|-----------------------|----------------------|
| <b>SW GRID 3</b> | <b>18.75</b>         | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| SW Segment 3.7   | 18.75                | 8.25                           | 0.44         | HF #2                | 0.43               | Interstory          | 8.25                 | 10.0           | 14.0                  | 15.0                 |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
| <b>SW GRID 4</b> | <b>32.50</b>         | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| 4.3              | 18.75                | 8.50                           | 0.45         | HF #2                | 0.43               | Interstory          | 8.50                 | 48.0           | 4.0                   | 15.0                 |
| 4.4              | 13.75                | 8.50                           | 0.62         | HF #2                | 0.43               | Interstory          | 8.50                 | 48.0           | 6.0                   | 15.0                 |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
| <b>SW GRID</b>   | <b>0.00</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
| <b>SW GRID</b>   | <b>0.00</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |

## Shear Wall Loads and Summary

| SW Mark          | EQ (lb) Wall (U/LT) | Wind (lb) Wall (U/LT) | Wall DL (lb) | Wall DL (lb) End 1 | Wall DL (lb) End 2 | Shear Wall Type | MIN. # of End Studs | Holddown           |
|------------------|---------------------|-----------------------|--------------|--------------------|--------------------|-----------------|---------------------|--------------------|
| <b>SW GRID 3</b> | 14111               | 3611                  | -            | -                  | -                  | -               | -                   | -                  |
| SW Segment 3.70  | 14111               | 3611                  | 5484         | -                  | -                  | SW-3            | 2                   | MSTC66 (5850 max.) |
|                  |                     |                       |              |                    |                    |                 |                     |                    |
|                  |                     |                       |              |                    |                    |                 |                     |                    |
| <b>SW GRID 4</b> | 8080                | 1346                  | -            | -                  | -                  | -               | -                   | -                  |
| 4.30             | 4662                | 777                   | 8775         | -                  | -                  | SW-6            | 2                   | No Strap           |
| 4.40             | 3418                | 569                   | 6848         | -                  | -                  | SW-6            | 2                   | No Strap           |
|                  |                     |                       |              |                    |                    |                 |                     |                    |
|                  |                     |                       |              |                    |                    |                 |                     |                    |
| <b>SW GRID</b>   |                     |                       |              |                    |                    |                 |                     |                    |
|                  |                     |                       |              |                    |                    |                 |                     |                    |
|                  |                     |                       |              |                    |                    |                 |                     |                    |
| <b>SW GRID</b>   |                     |                       |              |                    |                    |                 |                     |                    |
|                  |                     |                       |              |                    |                    |                 |                     |                    |
|                  |                     |                       |              |                    |                    |                 |                     |                    |

|   |                             |                 |                  |
|---|-----------------------------|-----------------|------------------|
|  <b>Quantum Consulting Engineers LLC</b><br>1511 Third Avenue, Suite 323<br>Seattle, WA 98101 | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|   |                             | Designer: MKS   | Sheet: 1         |
|   | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **High Roof (N-S)**

## Shear Wall Schedule (LRFD)

$\phi_p = 0.8$

| Shear Wall Type | Sheathing Grade, Sheathing Thickness, & Nail Size | Panel Edge Nail Spacing (in) | Nominal Seismic SW Capacity (plf) | LRFD Seismic SW Capacity (plf) | Nominal Wind SW Capacity (plf) | LRFD Wind SW Capacity (plf) | Sheathing Shear Stiffness, $G_s$ (lb/in) |
|-----------------|---|------------------------------|-----------------------------------|--------------------------------|--------------------------------|-----------------------------|--|
| SW-6            | APA Rated, 15/32", 10d Common                     | 6                            | 620                               | 496                            | 870                            | 696                         | 14                                       |
| SW-4            | APA Rated, 15/32", 10d Common                     | 4                            | 920                               | 736                            | 1290                           | 1032                        | 17                                       |
| SW-3            | APA Rated, 15/32", 10d Common                     | 3                            | 1200                              | 960                            | 1680                           | 1344                        | 19                                       |
| SW-2            | APA Rated, 15/32", 10d Common                     | 2                            | 1540                              | 1232                           | 2155                           | 1724                        | 23                                       |
| 2SW-4           | APA Rated, 15/32", 10d Common                     | 4                            | 1840                              | 1472                           | 2580                           | 2064                        | 34                                       |
| 2SW-3           | APA Rated, 15/32", 10d Common                     | 3                            | 2400                              | 1920                           | 3360                           | 2688                        | 38                                       |
| 2SW-2           | APA Rated, 15/32", 10d Common                     | 2                            | 3080                              | 2464                           | 4310                           | 3448                        | 46                                       |

## Determine Shear Wall Type (LRFD)

| SW Segment Mark | Seismic Shear (plf) | Aspect Ratio Reduction | Adjusted Seismic Shear (plf) | Wind Shear (plf) | Adjusted Wind Shear (plf) | Controlling Shear (plf) | Shear Wall Type | Shear Wall Capacity (plf) | Check | Controlling Shear |
|-----------------|---------------------|------------------------|------------------------------|------------------|---------------------------|-------------------------|-----------------|---------------------------|-------|-------------------|
| 3.70            | 753                 | 1.00                   | 809                          | 193              | 207                       | 809                     | SW-3            | 960                       | OK    | Seismic           |
| 4.30            | 249                 | 1.00                   | 267                          | 41               | 45                        | 267                     | SW-6            | 496                       | OK    | Seismic           |
| 4.40            | 249                 | 1.00                   | 267                          | 41               | 45                        | 267                     | SW-6            | 496                       | OK    | Seismic           |

\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

## Determine Shear Wall Overturning Moment Lever Arm

| SW Segment Mark | Wall Length Lever Arm (ft) | Calculated Lever Arm (ft) | % Different | Override Wall Length | User Input $M_{OT}$ Lever Arm (ft) |
|-----------------|----------------------------|---------------------------|-------------|----------------------|------------------------------------|
| 3.70            | 18.75                      | 18.54                     | 1.12%       | Yes                  | 17.00                              |
| 4.30            | 18.75                      | 18.54                     | 1.12%       | No                   |                                    |
| 4.40            | 13.75                      | 13.54                     | 1.54%       | No                   |                                    |

 **Quantum Consulting Engineers LLC**  
 1511 Third Avenue, Suite 323  
 Seattle, WA 98101

Project: Hong Kao Residence

Date: 10/12/23

Job No: 23127.01

Client: Chesmore Buck

Designer: MKS

Sheet: 3

Checked By: SHT

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**


Floor Level: **High Roof (N-S)**

### Shear Wall End Axial Load (ASD)

| SW Segment Mark | Seismic Tension (lb) | ASD Seismic Tension Above (lb) | Seismic Tension Total (lb) | Wind Tension (lb) | ASD Wind Tension Above (lb) | Wind Tension Total (lb) | End 1 Dead (lb) | End 2 Dead (lb) |
|-----------------|----------------------|--------------------------------|----------------------------|-------------------|-----------------------------|-------------------------|-----------------|-----------------|
| 3.70            | 4794                 |                                | 4794                       | 1051              |                             | 1051                    | 2742            | 2742            |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
| 4.30            | 1479                 |                                | 1479                       | 211               |                             | 211                     | 4388            | 4388            |
| 4.40            | 1479                 |                                | 1479                       | 211               |                             | 211                     | 3424            | 3424            |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |

### Determine Required Holddown (ASD)

| SW Segment Mark | Wind End 1 Eq. 16-15 | EQ End 1 Eq. 16-16 | Wind End 2 Eq. 16-15 | EQ End 2 Eq. 16-16 | Controlling Ten. Load (lb) | Holddown           | Holddown Capacity (lb) | Status |
|-----------------|----------------------|--------------------|----------------------|--------------------|----------------------------|--------------------|------------------------|--------|
| 3.7             | 594                  | -3521              | 594                  | -3521              | -3521                      | MSTC66 (5850 max.) | -5499                  | OK     |
|                 |                      |                    |                      |                    |                            |                    |                        |        |
|                 |                      |                    |                      |                    |                            |                    |                        |        |
|                 |                      |                    |                      |                    |                            |                    |                        |        |
| 4.3             | 2421                 | 557                | 2421                 | 557                | 557                        | No Strap           | 0                      | OK     |
| 4.4             | 1843                 | 110                | 1843                 | 110                | 110                        | No Strap           | 0                      | OK     |
|                 |                      |                    |                      |                    |                            |                    |                        |        |
|                 |                      |                    |                      |                    |                            |                    |                        |        |
|                 |                      |                    |                      |                    |                            |                    |                        |        |
|                 |                      |                    |                      |                    |                            |                    |                        |        |
|                 |                      |                    |                      |                    |                            |                    |                        |        |
|                 |                      |                    |                      |                    |                            |                    |                        |        |
|                 |                      |                    |                      |                    |                            |                    |                        |        |
|                 |                      |                    |                      |                    |                            |                    |                        |        |
|                 |                      |                    |                      |                    |                            |                    |                        |        |

|   |                             |                 |                  |
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|  <b>Quantum Consulting Engineers LLC</b><br>1511 Third Avenue, Suite 323<br>Seattle, WA 98101 | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|   |                             | Designer: MKS   | Sheet: 3         |
|   | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **High Roof (E-W)**

Sds = 0.97  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

## Shear Wall Line Information

| SW Mark          | L <sub>sw</sub> (ft) | Wall Pier<br>h <sub>wp</sub> (ft) | Aspect<br>Ratio | Wall Framing<br>Species | Specific<br>Gravity G | Interstory or<br>Base? | h <sub>sw</sub> (ft) | Wall Wt.<br>(psf) | Roof/Floor<br>Trib. (ft) | Roof/Floor<br>Wt. (psf) |
|------------------|----------------------|-----------------------------------|-----------------|-------------------------|-----------------------|------------------------|----------------------|-------------------|--------------------------|-------------------------|
| <b>SW GRID C</b> | <b>32.58</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| SW Segment C.6   | 21.33                | 8.50                              | 0.40            | HF #2                   | 0.43                  | Interstory             | 8.50                 | 48.0              | 2.0                      | 15.0                    |
| C.7              | 11.25                | 8.50                              | 0.76            | HF #2                   | 0.43                  | Interstory             | 8.50                 | 48.0              | 2.0                      | 15.0                    |
| <b>SW GRID D</b> | <b>19.75</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| D.4              | 19.75                | 8.50                              | 0.43            | HF #2                   | 0.43                  | Interstory             | 8.50                 | 48.0              | 2.0                      | 15.0                    |
| <b>SW GRID E</b> | <b>20.00</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| E.4              | 10.75                | 8.50                              | 0.79            | HF #2                   | 0.43                  | Interstory             | 8.50                 | 48.0              | 2.0                      | 15.0                    |
| E.5              | 9.25                 | 8.50                              | 0.92            | HF #2                   | 0.43                  | Interstory             | 8.50                 | 48.0              | 2.0                      | 15.0                    |
| <b>SW GRID</b>   | <b>0.00</b>          | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |

## Shear Wall Loads and Summary

| SW Mark          | EQ (lb) Wall<br>(U/L T) | Wind (lb) Wall<br>(U/L T) | Wall DL (lb) | Wall DL (lb)<br>End 1 | Wall DL (lb)<br>End 2 | Shear Wall Type | MIN. # of<br>End Studs | Holdown     |
|------------------|-------------------------|---------------------------|--------------|-----------------------|-----------------------|-----------------|------------------------|-------------|
| <b>SW GRID C</b> | 9899                    | 3103                      | -            | -                     | -                     | -               | -                      | -           |
| SW Segment C.6   | 6481                    | 2032                      | 9343         | -                     | -                     | SW-6            | 2                      | No Strap    |
| C.7              | 3418                    | 1071                      | 4928         | 1200                  | 1200                  | SW-6            | 2                      | CS16 (1705) |
| <b>SW GRID D</b> | 4952                    | 1541                      | -            | -                     | -                     | -               | -                      | -           |
| D.4              | 4952                    | 1541                      | 8651         | -                     | -                     | SW-6            | 2                      | No Strap    |
| <b>SW GRID E</b> | 4952                    | 1541                      | -            | -                     | -                     | -               | -                      | -           |
| E.4              | 2662                    | 828                       | 4709         | 200                   | 200                   | SW-6            | 2                      | CS16 (1705) |
| E.5              | 2290                    | 713                       | 4052         | 200                   | 200                   | SW-6            | 2                      | CS16 (1705) |
| <b>SW GRID</b>   | -                       | -                         | -            | -                     | -                     | -               | -                      | -           |



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Project: Hong Kao Residence

Date: 10/12/23

Job No: 23127.01

Designer: MKS

Sheet: 1

Client: Chesmore Buck

Checked By: SHT



# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **High Roof (E-W)**

## Shear Wall Schedule (LRFD)

$\phi_p = 0.8$

| Shear Wall Type | Sheathing Grade, Sheathing Thickness, & Nail Size | Panel Edge Nail Spacing (in) | Nominal Seismic SW Capacity (plf) | LRFD Seismic SW Capacity (plf) | Nominal Wind SW Capacity (plf) | LRFD Wind SW Capacity (plf) | Sheathing Shear Stiffness, $G_s$ (lb/in) |
|-----------------|---|------------------------------|-----------------------------------|--------------------------------|--------------------------------|-----------------------------|--|
| SW-6            | APA Rated, 15/32", 10d Common                     | 6                            | 620                               | 496                            | 870                            | 696                         | 14                                       |
| SW-4            | APA Rated, 15/32", 10d Common                     | 4                            | 920                               | 736                            | 1290                           | 1032                        | 17                                       |
| SW-3            | APA Rated, 15/32", 10d Common                     | 3                            | 1200                              | 960                            | 1680                           | 1344                        | 19                                       |
| SW-2            | APA Rated, 15/32", 10d Common                     | 2                            | 1540                              | 1232                           | 2155                           | 1724                        | 23                                       |
| 2SW-4           | APA Rated, 15/32", 10d Common                     | 4                            | 1840                              | 1472                           | 2580                           | 2064                        | 34                                       |
| 2SW-3           | APA Rated, 15/32", 10d Common                     | 3                            | 2400                              | 1920                           | 3360                           | 2688                        | 38                                       |
| 2SW-2           | APA Rated, 15/32", 10d Common                     | 2                            | 3080                              | 2464                           | 4310                           | 3448                        | 46                                       |

## Determine Shear Wall Type (LRFD)

| SW Segment Mark | Seismic Shear (plf) | Aspect Ratio Reduction | Adjusted Seismic Shear (plf) | Wind Shear (plf) | Adjusted Wind Shear (plf) | Controlling Shear (plf) | Shear Wall Type | Shear Wall Capacity (plf) | Check | Controlling Shear |
|-----------------|---------------------|------------------------|------------------------------|------------------|---------------------------|-------------------------|-----------------|---------------------------|-------|-------------------|
| C.6             | 304                 | 1.00                   | 327                          | 95               | 102                       | 327                     | SW-6            | 496                       | OK    | Seismic           |
| C.7             | 304                 | 1.00                   | 327                          | 95               | 102                       | 327                     | SW-6            | 496                       | OK    | Seismic           |
| D.4             | 251                 | 1.00                   | 270                          | 78               | 84                        | 270                     | SW-6            | 496                       | OK    | Seismic           |
| E.4             | 248                 | 1.00                   | 266                          | 77               | 83                        | 266                     | SW-6            | 496                       | OK    | Seismic           |
| E.5             | 248                 | 1.00                   | 266                          | 77               | 83                        | 266                     | SW-6            | 496                       | OK    | Seismic           |

\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

## Determine Shear Wall Overturning Moment Lever Arm

| SW Segment Mark | Wall Length Lever Arm (ft) | Calculated Lever Arm (ft) | % Different | Override Wall Length | User Input $M_{OT}$ Lever Arm (ft) |
|-----------------|----------------------------|---------------------------|-------------|----------------------|------------------------------------|
| C.6             | 21.33                      | 21.12                     | 0.99%       | No                   |                                    |
| C.7             | 11.25                      | 11.04                     | 1.89%       | No                   |                                    |
| D.4             | 19.75                      | 19.54                     | 1.07%       | No                   |                                    |
| E.4             | 10.75                      | 10.54                     | 1.98%       | No                   |                                    |
| E.5             | 9.25                       | 9.04                      | 2.30%       | No                   |                                    |

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# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018


Structure: **Koa and Hong Residence**  
 Floor Level: **High Roof (E-W)**

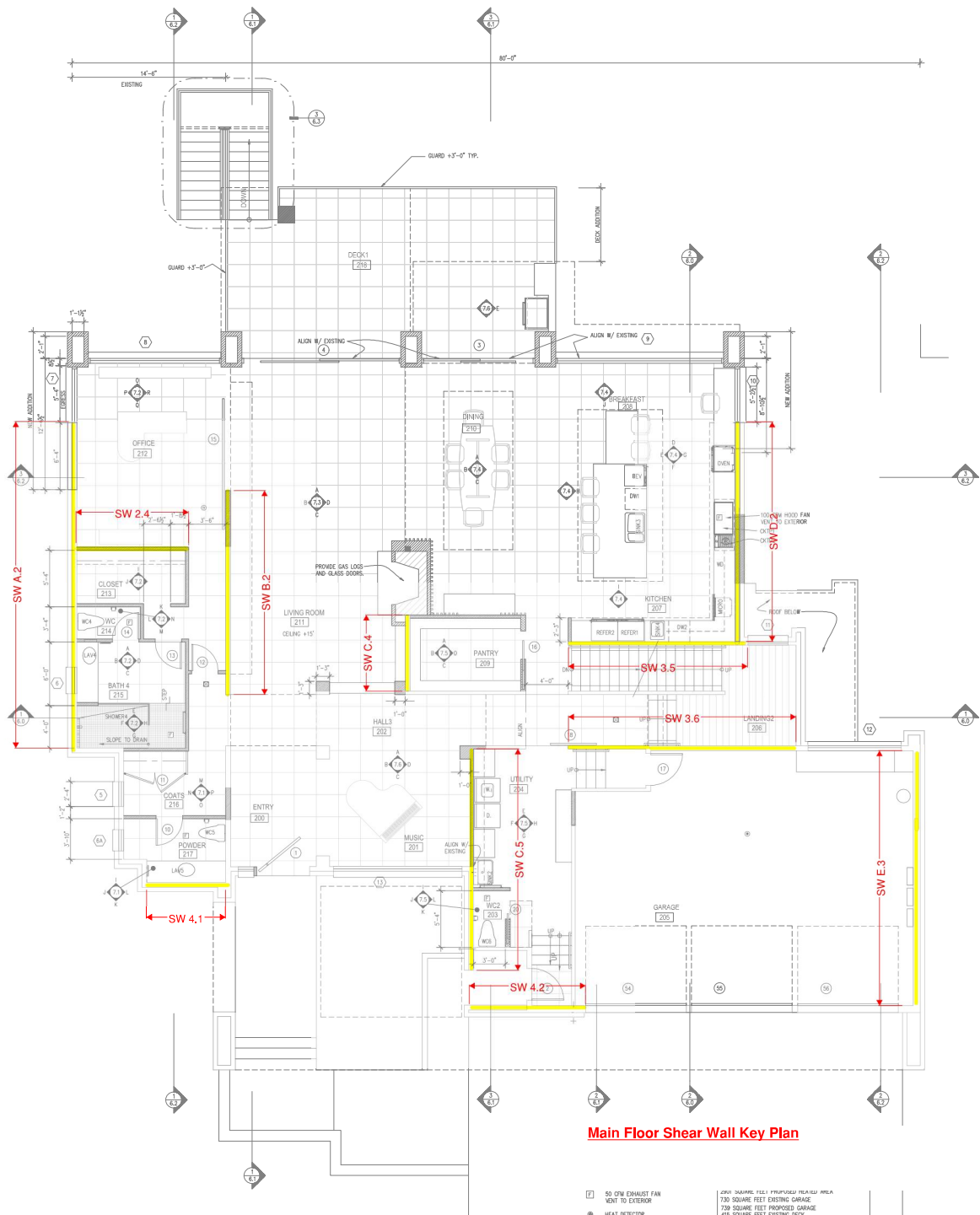
**Shear Wall End Axial Load (ASD)**

| SW Segment Mark | Seismic Tension (lb) | ASD Seismic Tension Above (lb) | Seismic Tension Total (lb) | Wind Tension (lb) | ASD Wind Tension Above (lb) | Wind Tension Total (lb) | End 1 Dead (lb) | End 2 Dead (lb) |
|-----------------|----------------------|--------------------------------|----------------------------|-------------------|-----------------------------|-------------------------|-----------------|-----------------|
| C.6             | 1808                 |                                | 1808                       | 486               |                             | 486                     | 4671            | 4671            |
| C.7             | 1808                 |                                | 1808                       | 486               |                             | 486                     | 3664            | 3664            |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
| D.4             | 1492                 |                                | 1492                       | 398               |                             | 398                     | 4325            | 4325            |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
| E.4             | 1473                 |                                | 1473                       | 393               |                             | 393                     | 2554            | 2554            |
| E.5             | 1473                 |                                | 1473                       | 393               |                             | 393                     | 2226            | 2226            |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |

**Determine Required Holdown (ASD)**

| SW Segment Mark | Wind End 1 Eq. 16-15 | EQ End 1 Eq. 16-16 | Wind End 2 Eq. 16-15 | EQ End 2 Eq. 16-16 | Controlling Ten. Load (lb) | Holdown     | Holdown Capacity (lb) | Status |
|-----------------|----------------------|--------------------|----------------------|--------------------|----------------------------|-------------|-----------------------|--------|
| C.6             | 2317                 | 361                | 2317                 | 361                | 361                        | No Strap    | 0                     | OK     |
| C.7             | 1713                 | -107               | 1713                 | -107               | -107                       | CS16 (1705) | -1705                 | OK     |
|                 |                      |                    |                      |                    |                            |             |                       |        |
| D.4             | 2197                 | 516                | 2197                 | 516                | 516                        | No Strap    | 0                     | OK     |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |
| E.4             | 1140                 | -288               | 1140                 | -288               | -288                       | CS16 (1705) | -1705                 | OK     |
| E.5             | 942                  | -440               | 942                  | -440               | -440                       | CS16 (1705) | -1705                 | OK     |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |

|  |   |                             |                 |                  |
|--|---|-----------------------------|-----------------|------------------|
|  | <b>Quantum Consulting Engineers LLC</b> | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|  | 1511 Third Avenue, Suite 323            |                             | Designer: MKS   | Sheet: 3         |
|  | Seattle, WA 98101                       | Client: Chesmore Buck       | Checked By: SHT |                  |



Xref C:\Users\Eric\Desktop\X-GRID.dwg

**Main Floor Shear Wall Key Plan**

- 50 CFM EXHAUST FAN VENT TO EXTERIOR
  - HEAT DETECTOR
- 2000 SQUARE FEET PROPOSED REARLY AREA  
 700 SQUARE FEET EXISTING GARAGE  
 700 SQUARE FEET PROPOSED GARAGE  
 410 SQUARE FEET EXISTING DECK  
 400 SQUARE FEET PROPOSED DECK

9/28/23  
 No. Date Revision

MAIN FLOOR

Sheet No. 3.1  
 Project No. 2222  
 Date: 9/8/23

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **Low Roof / Upper Floor (N-S)**


Sds = 0.97  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

## Shear Wall Line Information

| SW Mark          | L <sub>sw</sub> (ft) | Wall Pier<br>h <sub>wp</sub> (ft) | Aspect<br>Ratio | Wall Framing<br>Species | Specific<br>Gravity G | Interstory or<br>Base? | h <sub>sw</sub> (ft) | Wall Wt.<br>(psf) | Roof/Floor<br>Trib. (ft) | Roof/Floor<br>Wt. (psf) |
|------------------|----------------------|-----------------------------------|-----------------|-------------------------|-----------------------|------------------------|----------------------|-------------------|--------------------------|-------------------------|
| <b>SW GRID 2</b> | <b>10.50</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| SW Segment 2.4   | 10.50                | 8.00                              | 0.76            | HF #2                   | 0.43                  | Interstory             | 8.00                 | 10.0              | 2.0                      | 15.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID 3</b> | <b>38.25</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| 3.5              | 16.75                | 9.50                              | 0.57            | HF #2                   | 0.43                  | Interstory             | 9.50                 | 10.0              | 9.0                      | 12.0                    |
| 3.6              | 21.50                | 8.25                              | 0.38            | HF #2                   | 0.43                  | Interstory             | 8.25                 | 10.0              | 8.0                      | 12.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID 4</b> | <b>19.50</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| 4.1              | 8.50                 | 8.00                              | 0.94            | HF #2                   | 0.43                  | Base                   | 8.00                 | 10.0              | 2.0                      | 15.0                    |
| 4.2              | 11.00                | 8.25                              | 0.75            | HF #2                   | 0.43                  | Base                   | 8.25                 | 10.0              | 11.5                     | 30.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID</b>   | <b>0.00</b>          | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |

## Shear Wall Loads and Summary

| SW Mark          | EQ (lb) Wall<br>(U/LT) | Wind (lb) Wall<br>(U/LT) | Wall DL (lb) | Wall DL (lb)<br>End 1 | Wall DL (lb)<br>End 2 | Shear Wall Type | MIN. # of<br>End Studs | Holdown                   |
|------------------|------------------------|--------------------------|--------------|-----------------------|-----------------------|-----------------|------------------------|---------------------------|
| <b>SW GRID 2</b> | 5381                   | 6242                     | -            | -                     | -                     | -               | -                      | -                         |
| SW Segment 2.4   | 5381                   | 6242                     | 1155         |                       |                       | SW-4            | 2                      | MSTC48B3 (3975DF, 3900HF) |
|                  |                        |                          |              |                       |                       |                 |                        |                           |
|                  |                        |                          |              |                       |                       |                 |                        |                           |
| <b>SW GRID 3</b> | 35345                  | 15320                    |              |                       |                       |                 |                        |                           |
| 3.5              | 15478                  | 6709                     | 3400         | 2742                  | 2742                  | SW-2            | 2                      | CMST12 (9215)             |
| 3.6              | 19867                  | 8611                     | 3838         |                       |                       | SW-2            | 2                      | MSTC66 (5850 max.)        |
|                  |                        |                          |              |                       |                       |                 |                        |                           |
|                  |                        |                          |              |                       |                       |                 |                        |                           |
| <b>SW GRID 4</b> | 19583                  | 5222                     |              |                       |                       |                 |                        |                           |
| 4.1              | 8536                   | 2276                     | 935          |                       |                       | SW-2            | 2                      | HDU8 (6765DF, 5820HF)     |
| 4.20             | 11047                  | 2946                     | 4703         |                       |                       | SW-2            | 2                      | HDU8 (6765DF, 5820HF)     |
|                  |                        |                          |              |                       |                       |                 |                        |                           |
|                  |                        |                          |              |                       |                       |                 |                        |                           |
| <b>SW GRID</b>   |                        |                          |              |                       |                       |                 |                        |                           |
|                  |                        |                          |              |                       |                       |                 |                        |                           |
|                  |                        |                          |              |                       |                       |                 |                        |                           |

|   |                             |                 |                  |
|---|-----------------------------|-----------------|------------------|
|  <b>Quantum Consulting Engineers LLC</b><br>1511 Third Avenue, Suite 323<br>Seattle, WA 98101 | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|   |                             | Designer: MKS   | Sheet: 1         |
|   | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **Low Roof / Upper Floor (N-S)**

## Shear Wall Schedule (LRFD)

$\phi_p = 0.8$

| Shear Wall Type | Sheathing Grade, Sheathing Thickness, & Nail Size | Panel Edge Nail Spacing (in) | Nominal Seismic SW Capacity (plf) | LRFD Seismic SW Capacity (plf) | Nominal Wind SW Capacity (plf) | LRFD Wind SW Capacity (plf) | Sheathing Shear Stiffness, $G_s$ (lb/in) |
|-----------------|---|------------------------------|-----------------------------------|--------------------------------|--------------------------------|-----------------------------|--|
| SW-6            | APA Rated, 15/32", 10d Common                     | 6                            | 620                               | 496                            | 870                            | 696                         | 14                                       |
| SW-4            | APA Rated, 15/32", 10d Common                     | 4                            | 920                               | 736                            | 1290                           | 1032                        | 17                                       |
| SW-3            | APA Rated, 15/32", 10d Common                     | 3                            | 1200                              | 960                            | 1680                           | 1344                        | 19                                       |
| SW-2            | APA Rated, 15/32", 10d Common                     | 2                            | 1540                              | 1232                           | 2155                           | 1724                        | 23                                       |
| 2SW-4           | APA Rated, 15/32", 10d Common                     | 4                            | 1840                              | 1472                           | 2580                           | 2064                        | 34                                       |
| 2SW-3           | APA Rated, 15/32", 10d Common                     | 3                            | 2400                              | 1920                           | 3360                           | 2688                        | 38                                       |
| 2SW-2           | APA Rated, 15/32", 10d Common                     | 2                            | 3080                              | 2464                           | 4310                           | 3448                        | 46                                       |

## Determine Shear Wall Type (LRFD)

| SW Segment Mark | Seismic Shear (plf) | Aspect Ratio Reduction | Adjusted Seismic Shear (plf) | Wind Shear (plf) | Adjusted Wind Shear (plf) | Controlling Shear (plf) | Shear Wall Type | Shear Wall Capacity (plf) | Check | Controlling Shear |
|-----------------|---------------------|------------------------|------------------------------|------------------|---------------------------|-------------------------|-----------------|---------------------------|-------|-------------------|
| 2.4             | 512                 | 1.00                   | 551                          | 594              | 639                       | 551                     | SW-4            | 736                       | OK    | Seismic           |
| 3.5             | 924                 | 1.00                   | 994                          | 401              | 431                       | 994                     | SW-2            | 1232                      | OK    | Seismic           |
| 3.6             | 924                 | 1.00                   | 994                          | 401              | 431                       | 994                     | SW-2            | 1232                      | OK    | Seismic           |
| 4.1             | 1004                | 1.00                   | 1080                         | 268              | 288                       | 1080                    | SW-2            | 1232                      | OK    | Seismic           |
| 4.2             | 1004                | 1.00                   | 1080                         | 268              | 288                       | 1080                    | SW-2            | 1232                      | OK    | Seismic           |

\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

## Determine Shear Wall Overturning Moment Lever Arm

| SW Segment Mark | Wall Length Lever Arm (ft) | Calculated Lever Arm (ft) | % Different | Override Wall Length | User Input $M_{OT}$ Lever Arm (ft) |
|-----------------|----------------------------|---------------------------|-------------|----------------------|------------------------------------|
| 2.4             | 10.50                      | 10.29                     | 2.02%       | No                   |                                    |
| 3.5             | 16.75                      | 16.54                     | 1.26%       | No                   |                                    |
| 3.6             | 21.50                      | 21.29                     | 0.98%       | No                   |                                    |
| 4.1             | 8.50                       | 8.01                      | 6.11%       | No                   |                                    |
| 4.2             | 11.00                      | 10.51                     | 4.66%       | No                   |                                    |



**Quantum Consulting Engineers LLC**  
 1511 Third Avenue, Suite 323  
 Seattle, WA 98101

Project: Hong Kao Residence

Date: 10/12/23

Job No: 23127.01

Client: Chesmore Buck

Designer: MKS

Sheet: 3

Checked By: SHT

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018


Structure: **Koa and Hong Residence**  
 Floor Level: **Low Roof / Upper Floor (N-S)**

Shear Wall End Axial Load (ASD)

| SW Segment Mark | Seismic Tension (lb) | ASD Seismic Tension Above (lb) | Seismic Tension Total (lb) | Wind Tension (lb) | ASD Wind Tension Above (lb) | Wind Tension Total (lb) | End 1 Dead (lb) | End 2 Dead (lb) |
|-----------------|----------------------|--------------------------------|----------------------------|-------------------|-----------------------------|-------------------------|-----------------|-----------------|
| 2.4             | 2870                 |                                | 2870                       | 2853              |                             | 2853                    | 578             | 578             |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
| 3.5             | 6145                 | <b>4794</b>                    | 10939                      | 2283              | <b>1051</b>                 | 3334                    | 4442            | 4442            |
| 3.6             | 5336                 |                                | 5336                       | 1983              |                             | 1983                    | 1919            | 1919            |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
| 4.1             | 5624                 |                                | 5624                       | 1285              |                             | 1285                    | 468             | 468             |
| 4.2             | 5800                 |                                | 5800                       | 1326              |                             | 1326                    | 2351            | 2351            |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |

Determine Required Holdown (ASD)

| SW Segment Mark | Wind End 1 Eq. 16-15 | EQ End 1 Eq. 16-16 | Wind End 2 Eq. 16-15 | EQ End 2 Eq. 16-16 | Controlling Ten. Load (lb) | Holdown                   | Holdown Capacity (lb) | Status |
|-----------------|----------------------|--------------------|----------------------|--------------------|----------------------------|---------------------------|-----------------------|--------|
| 2.4             | -2507                | -2602              | -2507                | -2602              | <b>-2602</b>               | MSTC48B3 (3975DF, 3900HF) | <b>-3900</b>          | OK     |
|                 |                      |                    |                      |                    |                            |                           |                       |        |
|                 |                      |                    |                      |                    |                            |                           |                       |        |
| 3.5             | -669                 | -8876              | -669                 | -8876              | <b>-8876</b>               | CMST12 (9215)             | <b>-9215</b>          | OK     |
| 3.6             | -831                 | -4446              | -831                 | -4446              | <b>-4446</b>               | MSTC66 (5850 max.)        | <b>-5499</b>          | OK     |
|                 |                      |                    |                      |                    |                            |                           |                       |        |
|                 |                      |                    |                      |                    |                            |                           |                       |        |
| 4.1             | -1005                | -5407              | -1005                | -5407              | <b>-5407</b>               | HDU8 (6765DF, 5820HF)     | <b>-5820</b>          | OK     |
| 4.2             | 85                   | -4708              | 85                   | -4708              | <b>-4708</b>               | HDU8 (6765DF, 5820HF)     | <b>-5820</b>          | OK     |
|                 |                      |                    |                      |                    |                            |                           |                       |        |
|                 |                      |                    |                      |                    |                            |                           |                       |        |
|                 |                      |                    |                      |                    |                            |                           |                       |        |
|                 |                      |                    |                      |                    |                            |                           |                       |        |

|  |   |                             |                 |                  |
|--|---|-----------------------------|-----------------|------------------|
|  | <b>Quantum Consulting Engineers LLC</b> | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|  | 1511 Third Avenue, Suite 323            |                             | Designer: MKS   | Sheet: 3         |
|  | Seattle, WA 98101                       | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **Low Roof / Upper Floor (E-W)**


Sds = 0.97  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

## Shear Wall Line Information

| SW Mark          | L <sub>sw</sub> (ft) | Wall Pier<br>h <sub>wp</sub> (ft) | Aspect<br>Ratio | Wall Framing<br>Species | Specific<br>Gravity G | Interstory or<br>Base? | h <sub>sw</sub> (ft) | Wall Wt.<br>(psf) | Roof/Floor<br>Trib. (ft) | Roof/Floor<br>Wt. (psf) |
|------------------|----------------------|-----------------------------------|-----------------|-------------------------|-----------------------|------------------------|----------------------|-------------------|--------------------------|-------------------------|
| <b>SW GRID A</b> | <b>30.75</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| SW Segment A.2   | 30.75                | 8.00                              | 0.26            | HF #2                   | 0.43                  | Interstory             | 8.00                 | 48.0              | 7.0                      | 15.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID B</b> | <b>19.25</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| B.2              | 19.25                | 10.50                             | 0.55            | HF #2                   | 0.43                  | Interstory             | 10.50                | 10.0              | 6.0                      | 15.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID C</b> | <b>28.50</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| C.4              | 7.25                 | 10.50                             | 1.45            | HF #2                   | 0.43                  | Interstory             | 10.50                | 10.0              | 8.0                      | 15.0                    |
| C.5              | 21.25                | 9.50                              | 0.45            | HF #2                   | 0.43                  | Base                   | 9.50                 | 48.0              | 2.0                      | 30.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID D</b> | <b>20.75</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| D.2              | 20.75                | 9.50                              | 0.46            | HF #2                   | 0.43                  | Interstory             | 9.50                 | 48.0              | 2.0                      | 15.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |

## Shear Wall Loads and Summary

| SW Mark          | EQ (lb) Wall<br>(ULT) | Wind (lb) Wall<br>(ULT) | Wall DL (lb) | Wall DL (lb)<br>End 1 | Wall DL (lb)<br>End 2 | Shear Wall Type | MIN. # of<br>End Studs | Holddown              |
|------------------|-----------------------|-------------------------|--------------|-----------------------|-----------------------|-----------------|------------------------|-----------------------|
| <b>SW GRID A</b> | 2518                  | 749                     | -            | -                     | -                     | -               | -                      | -                     |
| SW Segment A.2   | 2518                  | 749                     | 15037        |                       |                       | SW-6            | 2                      | No Strap              |
|                  |                       |                         |              |                       |                       |                 |                        |                       |
| <b>SW GRID B</b> | 9400                  | 2290                    |              |                       |                       |                 |                        |                       |
| B.2              | 9400                  | 2290                    | 3754         |                       |                       | SW-4            | 2                      | (2) CS16 (3410)       |
|                  |                       |                         |              |                       |                       |                 |                        |                       |
| <b>SW GRID C</b> | 24153                 | 9651                    |              |                       |                       |                 |                        |                       |
| C.4              | 6144                  | 2455                    | 1631         |                       |                       | SW-2            | 2                      | CMST12 (9215)         |
| C.5              | 18009                 | 7196                    | 10965        | 200                   | 200                   | SW-2            | 2                      | HDU4 (4565DF, 3285HF) |
|                  |                       |                         |              |                       |                       |                 |                        |                       |
| <b>SW GRID D</b> | 8854                  | 2696                    |              |                       |                       |                 |                        |                       |
| D.2              | 8854                  | 2696                    | 10085        | 4325                  | 4325                  | SW-6            | 2                      | No Strap              |
|                  |                       |                         |              |                       |                       |                 |                        |                       |

|   |                             |                 |                  |
|---|-----------------------------|-----------------|------------------|
|  <b>Quantum Consulting Engineers LLC</b><br>1511 Third Avenue, Suite 323<br>Seattle, WA 98101 | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|   |                             | Designer: MKS   | Sheet: 1         |
|   | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **Low Roof / Upper Floor (E-W)**

## Shear Wall Schedule (LRFD)

$\phi_p = 0.8$

| Shear Wall Type | Sheathing Grade, Sheathing Thickness, & Nail Size | Panel Edge Nail Spacing (in) | Nominal Seismic SW Capacity (plf) | LRFD Seismic SW Capacity (plf) | Nominal Wind SW Capacity (plf) | LRFD Wind SW Capacity (plf) | Sheathing Shear Stiffness, $G_s$ (lb/in) |
|-----------------|---|------------------------------|-----------------------------------|--------------------------------|--------------------------------|-----------------------------|--|
| SW-6            | APA Rated, 15/32", 10d Common                     | 6                            | 620                               | 496                            | 870                            | 696                         | 14                                       |
| SW-4            | APA Rated, 15/32", 10d Common                     | 4                            | 920                               | 736                            | 1290                           | 1032                        | 17                                       |
| SW-3            | APA Rated, 15/32", 10d Common                     | 3                            | 1200                              | 960                            | 1680                           | 1344                        | 19                                       |
| SW-2            | APA Rated, 15/32", 10d Common                     | 2                            | 1540                              | 1232                           | 2155                           | 1724                        | 23                                       |
| 2SW-4           | APA Rated, 15/32", 10d Common                     | 4                            | 1840                              | 1472                           | 2580                           | 2064                        | 34                                       |
| 2SW-3           | APA Rated, 15/32", 10d Common                     | 3                            | 2400                              | 1920                           | 3360                           | 2688                        | 38                                       |
| 2SW-2           | APA Rated, 15/32", 10d Common                     | 2                            | 3080                              | 2464                           | 4310                           | 3448                        | 46                                       |

## Determine Shear Wall Type (LRFD)

| SW Segment Mark | Seismic Shear (plf) | Aspect Ratio Reduction | Adjusted Seismic Shear (plf) | Wind Shear (plf) | Adjusted Wind Shear (plf) | Controlling Shear (plf) | Shear Wall Type | Shear Wall Capacity (plf) | Check | Controlling Shear |
|-----------------|---------------------|------------------------|------------------------------|------------------|---------------------------|-------------------------|-----------------|---------------------------|-------|-------------------|
| A.2             | 82                  | 1.00                   | 88                           | 24               | 26                        | 88                      | SW-6            | 496                       | OK    | Seismic           |
| B.2             | 488                 | 1.00                   | 525                          | 119              | 128                       | 525                     | SW-4            | 736                       | OK    | Seismic           |
| C.4             | 847                 | 1.00                   | 911                          | 339              | 364                       | 911                     | SW-2            | 1232                      | OK    | Seismic           |
| C.5             | 847                 | 1.00                   | 911                          | 339              | 364                       | 911                     | SW-2            | 1232                      | OK    | Seismic           |
| D.2             | 427                 | 1.00                   | 459                          | 130              | 140                       | 459                     | SW-6            | 496                       | OK    | Seismic           |

\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

## Determine Shear Wall Overturning Moment Lever Arm

| SW Segment Mark | Wall Length Lever Arm (ft) | Calculated Lever Arm (ft) | % Different | Override Wall Length | User Input $M_{OT}$ Lever Arm (ft) |
|-----------------|----------------------------|---------------------------|-------------|----------------------|------------------------------------|
| A.2             | 30.75                      | 30.54                     | 0.68%       | No                   |                                    |
| B.2             | 19.25                      | 19.04                     | 1.09%       | No                   |                                    |
| C.4             | 7.25                       | 7.04                      | 2.96%       | No                   |                                    |
| C.5             | 21.25                      | 20.77                     | 2.33%       | No                   |                                    |
| D.2             | 20.75                      | 20.54                     | 1.01%       | No                   |                                    |

 **Quantum Consulting Engineers LLC**  
 1511 Third Avenue, Suite 323  
 Seattle, WA 98101

Project: Hong Kao Residence      Date: 10/12/23      Job No: 23127.01  
 Designer: MKS      Sheet: 3  
 Client: Chesmore Buck      Checked By: SHT



# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018


Structure: **Koa and Hong Residence**  
 Floor Level: **Low Roof / Upper Floor (E-W)**

Shear Wall End Axial Load (ASD)

| SW Segment Mark | Seismic Tension (lb) | ASD Seismic Tension Above (lb) | Seismic Tension Total (lb) | Wind Tension (lb) | ASD Wind Tension Above (lb) | Wind Tension Total (lb) | End 1 Dead (lb) | End 2 Dead (lb) |
|-----------------|----------------------|--------------------------------|----------------------------|-------------------|-----------------------------|-------------------------|-----------------|-----------------|
| A.2             | 459                  |                                | 459                        | 117               |                             | 117                     | 7518            | 7518            |
| B.2             | 3589                 |                                | 3589                       | 749               |                             | 749                     | 1877            | 1877            |
| C.4             | 6229                 |                                | 6229                       | 2133              |                             | 2133                    | 816             | 816             |
| C.5             | 5636                 |                                | 5636                       | 1930              |                             | 1930                    | 5683            | 5683            |
| D.2             | 2838                 | 1492                           | 4329                       | 741               | 398                         | 1139                    | 9368            | 9368            |

Determine Required Holdown (ASD)

| SW Segment Mark | Wind End 1 Eq. 16-15 | EQ End 1 Eq. 16-16 | Wind End 2 Eq. 16-15 | EQ End 2 Eq. 16-16 | Controlling Ten. Load (lb) | Holdown               | Holdown Capacity (lb) | Status |
|-----------------|----------------------|--------------------|----------------------|--------------------|----------------------------|-----------------------|-----------------------|--------|
| A.2             | 4394                 | 3031               | 4394                 | 3031               | 3031                       | No Strap              | 0                     | OK     |
| B.2             | 377                  | -2718              | 377                  | -2718              | -2718                      | (2) CS16 (3410)       | -3410                 | OK     |
| C.4             | -1644                | -5850              | -1644                | -5850              | -5850                      | CMST12 (9215)         | -9215                 | OK     |
| C.5             | 1479                 | -2998              | 1479                 | -2998              | -2998                      | HDU4 (4565DF, 3285HF) | -3285                 | OK     |
| D.2             | 4482                 | 19                 | 4482                 | 19                 | 19                         | No Strap              | 0                     | OK     |

|   |                             |                 |                  |
|---|-----------------------------|-----------------|------------------|
|  <b>Quantum Consulting Engineers LLC</b><br>1511 Third Avenue, Suite 323<br>Seattle, WA 98101 | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|   |                             | Designer: MKS   | Sheet: 3         |
|   | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **Low Roof / Upper Floor Continued (E-W)**

Sds = 0.97  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

## Shear Wall Line Information

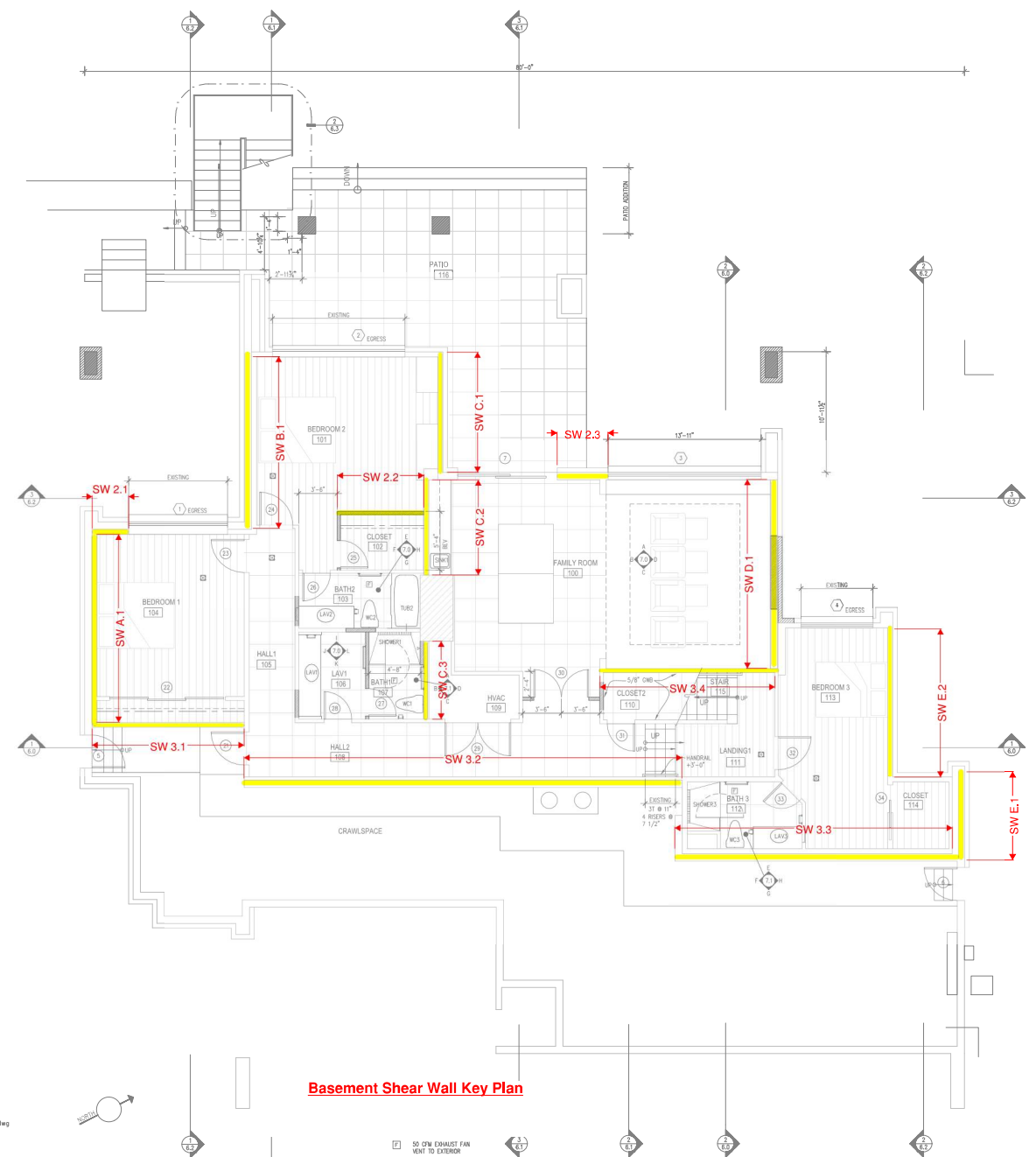
| SW Mark          | L <sub>sw</sub> (ft) | Wall Pier<br>h <sub>wp</sub> (ft) | Aspect<br>Ratio | Wall Framing<br>Species | Specific<br>Gravity G | Interstory or<br>Base? | h <sub>sw</sub> (ft) | Wall Wt.<br>(psf) | Roof/Floor<br>Trib. (ft) | Roof/Floor<br>Wt. (psf) |
|------------------|----------------------|-----------------------------------|-----------------|-------------------------|-----------------------|------------------------|----------------------|-------------------|--------------------------|-------------------------|
| <b>SW GRID</b> E | <b>24.00</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| SW Segment E.3   | 24.00                | 8.25                              | 0.34            | HF #2                   | 0.43                  | Interstory             | 8.25                 | 48.0              | 2.0                      | 12.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID</b>   | <b>0.00</b>          | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID</b>   | <b>0.00</b>          | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID</b>   | <b>0.00</b>          | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |

## Shear Wall Loads and Summary

| SW Mark          | EQ (lb) Wall<br>(ULT) | Wind (lb) Wall<br>(ULT) | Wall DL (lb) | Wall DL (lb)<br>End 1 | Wall DL (lb)<br>End 2 | Shear Wall Type | MIN. # of<br>End Studs | Holddown           |
|------------------|-----------------------|-------------------------|--------------|-----------------------|-----------------------|-----------------|------------------------|--------------------|
| <b>SW GRID</b> E | 10725                 | 6955                    | -            | -                     | -                     | -               | -                      | -                  |
| SW Segment E.3   | 10725                 | 6955                    | 10080        | 2554                  | 2226                  | <b>SW-6</b>     | <b>2</b>               | <b>CS16 (1705)</b> |
|                  |                       |                         |              |                       |                       |                 |                        |                    |
| <b>SW GRID</b>   |                       |                         |              |                       |                       |                 |                        |                    |
|                  |                       |                         |              |                       |                       |                 |                        |                    |
| <b>SW GRID</b>   |                       |                         |              |                       |                       |                 |                        |                    |
|                  |                       |                         |              |                       |                       |                 |                        |                    |
| <b>SW GRID</b>   |                       |                         |              |                       |                       |                 |                        |                    |
|                  |                       |                         |              |                       |                       |                 |                        |                    |







**Basement Shear Wall Key Plan**

xref C:\Users\Eric\Desktop\X-CRD.dwg

- 50 CFM EXHAUST FAN  
 VENT TO EXTERIOR
- LEGEND**
- EXISTING CONSTRUCTION TO BE REMOVED
  - - - - NEW 2X6 EXTERIOR (2X4 INTERIOR) STUD WALLS @ 16" O.C.
  - ===== NEW 2X8 STUDS @ 16" O.C.
  - ===== EXISTING CONSTRUCTION
- 1994 SQUARE FEET EXISTING HEATED FLOOR AREA PER IRC R202  
 1994 SQUARE FEET PROPOSED HEATED FLOOR AREA
- NOTE:  
 SMOKE ALARMS SHALL BE INTERCONNECTED IN SUCH A MANNER THAT THE ACTIVATION OF ONE ALARM WILL ACTIVATE ALL OF THE ALARMS.

9/28/23  
 No. Date Revision

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **Main Floor (N-S)**

Sds = 0.97  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

## Shear Wall Line Information

| SW Mark          | L <sub>sw</sub> (ft) | Wall Pier<br>h <sub>wp</sub> (ft) | Aspect<br>Ratio | Wall Framing<br>Species | Specific<br>Gravity G | Interstory or<br>Base? | h <sub>sw</sub> (ft) | Wall Wt.<br>(psf) | Roof/Floor<br>Trib. (ft) | Roof/Floor<br>Wt. (psf) |      |
|------------------|----------------------|-----------------------------------|-----------------|-------------------------|-----------------------|------------------------|----------------------|-------------------|--------------------------|-------------------------|------|
| <b>SW GRID 2</b> | <b>15.58</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |      |
| SW Segment       | 2.1                  | 3.33                              | 10.25           | 3.08                    | HF #2                 | 0.43                   | Base                 | 10.25             | 10.0                     | 4.0                     | 12.0 |
|                  | 2.2                  | 7.75                              | 10.25           | 1.32                    | HF #2                 | 0.43                   | Base                 | 10.25             | 10.0                     | 4.0                     | 12.0 |
|                  | 2.3                  | 4.50                              | 10.25           | 2.28                    | HF #2                 | 0.43                   | Base                 | 10.25             | 10.0                     | 4.0                     | 12.0 |
| <b>SW GRID 3</b> | <b>95.75</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |      |
|                  | 3.1                  | 14.25                             | 10.50           | 0.74                    | HF #2                 | 0.43                   | Base                 | 10.50             | 10.0                     | 4.0                     | 12.0 |
|                  | 3.2                  | 39.75                             | 7.50            | 0.19                    | HF #2                 | 0.43                   | Base                 | 7.50              | 10.0                     | 4.0                     | 12.0 |
|                  | 3.3                  | 25.75                             | 7.50            | 0.29                    | HF #2                 | 0.43                   | Base                 | 7.50              | 10.0                     | 4.0                     | 12.0 |
|                  | 3.4                  | 16.00                             | 10.50           | 0.66                    | HF #2                 | 0.43                   | Base                 | 10.50             | 10.0                     | 4.0                     | 12.0 |
| <b>SW GRID</b>   | <b>0.00</b>          | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |      |
| <b>SW GRID</b>   | <b>0.00</b>          | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |      |

## Shear Wall Loads and Summary

| SW Mark          | EQ (lb) Wall<br>(U/L T) | Wind (lb) Wall<br>(U/L T) | Wall DL (lb) | Wall DL (lb)<br>End 1 | Wall DL (lb)<br>End 2 | Shear Wall Type | MIN. # of<br>End Studs | Holddown                           |
|------------------|-------------------------|---------------------------|--------------|-----------------------|-----------------------|-----------------|------------------------|------------------------------------|
| <b>SW GRID 2</b> | 15128                   | 9853                      | -            | -                     | -                     | -               | -                      | -                                  |
| SW Segment       | 2.10                    | 3236                      | 2107         | 502                   | -                     | SW-2            | 4                      | HDU11 (4) Studs (9335DF, 8030HF)   |
|                  | 2.20                    | 7524                      | 4900         | 1166                  | -                     | SW-2            | 4                      | HDU11 (4) Studs (9335DF, 8030HF)   |
|                  | 2.30                    | 4369                      | 2845         | 677                   | -                     | SW-2            | 4                      | HDU11 (4) Studs (9335DF, 8030HF)   |
| <b>SW GRID 3</b> | 47947                   | 26092                     | -            | -                     | -                     | -               | -                      | -                                  |
|                  | 3.10                    | 7136                      | 3883         | 2180                  | -                     | SW-4            | 2                      | HDU4 (4565DF, 3285HF)              |
|                  | 3.20                    | 19905                     | 10832        | 4889                  | -                     | SW-4            | 2                      | HDU2 (3075DF, 2215HF)              |
|                  | 3.30                    | 12894                     | 7017         | 3167                  | -                     | SW-4            | 2                      | HDU2 (3075DF, 2215HF)              |
|                  | 3.40                    | 8012                      | 4360         | 2448                  | 4442                  | SW-4            | 5                      | HDU14 (5) Studs (14390DF, 12375HF) |
| <b>SW GRID</b>   |                         |                           |              |                       |                       |                 |                        |                                    |
| <b>SW GRID</b>   |                         |                           |              |                       |                       |                 |                        |                                    |



**Quantum Consulting Engineers LLC**  
 1511 Third Avenue, Suite 323  
 Seattle, WA 98101

Project: Hong Kao Residence

Date: 10/12/23

Job No: 23127.01

Designer: MKS

Sheet: 1

Client: Chesmore Buck

Checked By: SHT

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **Main Floor (N-S)**

## Shear Wall Schedule (LRFD)

$\phi_p = 0.8$

| Shear Wall Type | Sheathing Grade, Sheathing Thickness, & Nail Size | Panel Edge Nail Spacing (in) | Nominal Seismic SW Capacity (plf) | LRFD Seismic SW Capacity (plf) | Nominal Wind SW Capacity (plf) | LRFD Wind SW Capacity (plf) | Sheathing Shear Stiffness, $G_s$ (lb/in) |
|-----------------|---|------------------------------|-----------------------------------|--------------------------------|--------------------------------|-----------------------------|--|
| SW-6            | APA Rated, 15/32", 10d Common                     | 6                            | 620                               | 496                            | 870                            | 696                         | 14                                       |
| SW-4            | APA Rated, 15/32", 10d Common                     | 4                            | 920                               | 736                            | 1290                           | 1032                        | 17                                       |
| SW-3            | APA Rated, 15/32", 10d Common                     | 3                            | 1200                              | 960                            | 1680                           | 1344                        | 19                                       |
| SW-2            | APA Rated, 15/32", 10d Common                     | 2                            | 1540                              | 1232                           | 2155                           | 1724                        | 23                                       |
| 2SW-4           | APA Rated, 15/32", 10d Common                     | 4                            | 1840                              | 1472                           | 2580                           | 2064                        | 34                                       |
| 2SW-3           | APA Rated, 15/32", 10d Common                     | 3                            | 2400                              | 1920                           | 3360                           | 2688                        | 38                                       |
| 2SW-2           | APA Rated, 15/32", 10d Common                     | 2                            | 3080                              | 2464                           | 4310                           | 3448                        | 46                                       |

## Determine Shear Wall Type (LRFD)

| SW Segment Mark | Seismic Shear (plf) | Aspect Ratio Reduction | Adjusted Seismic Shear (plf) | Wind Shear (plf) | Adjusted Wind Shear (plf) | Controlling Shear (plf) | Shear Wall Type | Shear Wall Capacity (plf) | Check | Controlling Shear |
|-----------------|---------------------|------------------------|------------------------------|------------------|---------------------------|-------------------------|-----------------|---------------------------|-------|-------------------|
| 2.10            | 971                 | 0.87                   | 1206                         | 632              | 785                       | 1206                    | SW-2            | 1232                      | OK    | Seismic           |
| 2.20            | 971                 | 1.00                   | 1044                         | 632              | 680                       | 1044                    | SW-2            | 1232                      | OK    | Seismic           |
| 2.30            | 971                 | 0.97                   | 1081                         | 632              | 704                       | 1081                    | SW-2            | 1232                      | OK    | Seismic           |
| 3.10            | 501                 | 1.00                   | 538                          | 273              | 293                       | 538                     | SW-4            | 736                       | OK    | Seismic           |
| 3.20            | 501                 | 1.00                   | 538                          | 273              | 293                       | 538                     | SW-4            | 736                       | OK    | Seismic           |
| 3.30            | 501                 | 1.00                   | 538                          | 273              | 293                       | 538                     | SW-4            | 736                       | OK    | Seismic           |
| 3.40            | 501                 | 1.00                   | 538                          | 273              | 293                       | 538                     | SW-4            | 736                       | OK    | Seismic           |

\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

## Determine Shear Wall Overturning Moment Lever Arm

| SW Segment Mark | Wall Length Lever Arm (ft) | Calculated Lever Arm (ft) | % Different | Override Wall Length | User Input $M_{OT}$ Lever Arm (ft) |
|-----------------|----------------------------|---------------------------|-------------|----------------------|------------------------------------|
| 2.10            | 3.33                       | 2.59                      | 28.52%      | No                   |                                    |
| 2.20            | 7.75                       | 7.01                      | 10.55%      | No                   |                                    |
| 2.30            | 4.50                       | 3.76                      | 19.67%      | No                   |                                    |
| 3.10            | 14.25                      | 13.77                     | 3.52%       | No                   |                                    |
| 3.20            | 39.75                      | 39.27                     | 1.23%       | No                   |                                    |
| 3.30            | 25.75                      | 25.27                     | 1.92%       | No                   |                                    |
| 3.40            | 16.00                      | 15.12                     | 5.82%       | No                   |                                    |

 **Quantum Consulting Engineers LLC**  
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Project: Hong Kao Residence

Date: 10/12/23

Job No: 23127.01

Client: Chesmore Buck

Designer: MKS

Sheet: 3

Checked By: SHT





# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **Main Floor (E-W)**

Sds = 0.97  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

## Shear Wall Line Information

| SW Mark          | L <sub>sw</sub> (ft) | Wall Pier<br>h <sub>wp</sub> (ft) | Aspect<br>Ratio | Wall Framing<br>Species | Specific<br>Gravity G | Interstory or<br>Base? | h <sub>sw</sub> (ft) | Wall Wt.<br>(psf) | Roof/Floor<br>Trib. (ft) | Roof/Floor<br>Wt. (psf) |
|------------------|----------------------|-----------------------------------|-----------------|-------------------------|-----------------------|------------------------|----------------------|-------------------|--------------------------|-------------------------|
| <b>SW GRID A</b> | <b>17.00</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| SW Segment A.1   | 17.00                | 10.00                             | 0.59            | HF #2                   | 0.43                  | Base                   | 10.00                | 48.0              | 7.0                      | 12.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID B</b> | <b>15.75</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| B.1              | 15.75                | 10.50                             | 0.67            | HF #2                   | 0.43                  | Base                   | 10.25                | 48.0              | 15.0                     | 12.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID C</b> | <b>27.00</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| C.1              | 11.00                | 10.25                             | 0.93            | HF #2                   | 0.43                  | Base                   | 10.25                | 48.0              | 15.0                     | 12.0                    |
| C.2              | 9.00                 | 10.25                             | 1.14            | HF #2                   | 0.43                  | Base                   | 10.25                | 10.0              | 15.0                     | 12.0                    |
| C.3              | 7.00                 | 10.25                             | 1.46            | HF #2                   | 0.43                  | Base                   | 10.25                | 10.0              | 15.0                     | 12.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID D</b> | <b>17.00</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| D.1              | 17.00                | 10.25                             | 0.60            | HF #2                   | 0.43                  | Base                   | 10.25                | 48.0              | 8.0                      | 12.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |

## Shear Wall Loads and Summary

| SW Mark          | EQ (lb) Wall<br>(ULT) | Wind (lb) Wall<br>(ULT) | Wall DL (lb) | Wall DL (lb)<br>End 1 | Wall DL (lb)<br>End 2 | Shear Wall Type | MIN. # of<br>End Studs | Holddown              |
|------------------|-----------------------|-------------------------|--------------|-----------------------|-----------------------|-----------------|------------------------|-----------------------|
| <b>SW GRID A</b> | 2450                  | 2375                    | -            | -                     | -                     | -               | -                      | -                     |
| SW Segment A.1   | 2450                  | 2375                    | 9588         |                       |                       | SW-6            | 2                      | No HD                 |
|                  |                       |                         |              |                       |                       |                 |                        |                       |
|                  |                       |                         |              |                       |                       |                 |                        |                       |
| <b>SW GRID B</b> | 12110                 | 6441                    |              |                       |                       |                 |                        |                       |
| B.1              | 12110                 | 6441                    | 10584        |                       |                       | SW-3            | 2                      | HDU5 (5645DF, 4340HF) |
|                  |                       |                         |              |                       |                       |                 |                        |                       |
|                  |                       |                         |              |                       |                       |                 |                        |                       |
| <b>SW GRID C</b> | 22490                 | 16136                   |              |                       |                       |                 |                        |                       |
| C.1              | 9163                  | 6574                    | 7392         |                       |                       | SW-3            | 2                      | HDU5 (5645DF, 4340HF) |
| C.2              | 7497                  | 5379                    | 2543         |                       |                       | SW-3            | 2                      | HDU8 (6765DF, 5820HF) |
| C.3              | 5831                  | 4183                    | 1978         |                       |                       | SW-3            | 2                      | HDU8 (6765DF, 5820HF) |
|                  |                       |                         |              |                       |                       |                 |                        |                       |
|                  |                       |                         |              |                       |                       |                 |                        |                       |
| <b>SW GRID D</b> | 5070                  | 8175                    |              |                       |                       |                 |                        |                       |
| D.1              | 5070                  | 8175                    | 9996         |                       |                       | SW-6            | 2                      | No HD                 |
|                  |                       |                         |              |                       |                       |                 |                        |                       |
|                  |                       |                         |              |                       |                       |                 |                        |                       |



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Client: Chesmore Buck

Checked By: SHT

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **Main Floor (E-W)**

## Shear Wall Schedule (LRFD)

$\phi_p = 0.8$

| Shear Wall Type | Sheathing Grade, Sheathing Thickness, & Nail Size | Panel Edge Nail Spacing (in) | Nominal Seismic SW Capacity (plf) | LRFD Seismic SW Capacity (plf) | Nominal Wind SW Capacity (plf) | LRFD Wind SW Capacity (plf) | Sheathing Shear Stiffness, $G_s$ (lb/in) |
|-----------------|---|------------------------------|-----------------------------------|--------------------------------|--------------------------------|-----------------------------|--|
| SW-6            | APA Rated, 15/32", 10d Common                     | 6                            | 620                               | 496                            | 870                            | 696                         | 14                                       |
| SW-4            | APA Rated, 15/32", 10d Common                     | 4                            | 920                               | 736                            | 1290                           | 1032                        | 17                                       |
| SW-3            | APA Rated, 15/32", 10d Common                     | 3                            | 1200                              | 960                            | 1680                           | 1344                        | 19                                       |
| SW-2            | APA Rated, 15/32", 10d Common                     | 2                            | 1540                              | 1232                           | 2155                           | 1724                        | 23                                       |
| 2SW-4           | APA Rated, 7/16", 8d Common                       | 4                            | 1520                              | 1216                           | 2130                           | 1704                        | 26                                       |
| 2SW-3           | APA Rated, 7/16", 8d Common                       | 3                            | 1960                              | 1568                           | 2740                           | 2192                        | 30                                       |
| 2SW-2           | APA Rated, 7/16", 8d Common                       | 2                            | 2560                              | 2048                           | 3580                           | 2864                        | 40                                       |

\*\*See SDPWS Table 4.3A Note 2

## Determine Shear Wall Type (LRFD)

| SW Segment Mark | Seismic Shear (plf) | Aspect Ratio Reduction | Adjusted Seismic Shear (plf) | Wind Shear (plf) | Adjusted Wind Shear (plf) | Controlling Shear (plf) | Shear Wall Type | Shear Wall Capacity (plf) | Check | Controlling Shear |
|-----------------|---------------------|------------------------|------------------------------|------------------|---------------------------|-------------------------|-----------------|---------------------------|-------|-------------------|
| A.1             | 144                 | 1.00                   | 155                          | 140              | 150                       | 155                     | SW-6            | 496                       | OK    | Seismic           |
| B.1             | 769                 | 1.00                   | 827                          | 409              | 440                       | 827                     | SW-3            | 960                       | OK    | Seismic           |
| C.1             | 833                 | 1.00                   | 896                          | 598              | 643                       | 896                     | SW-3            | 960                       | OK    | Seismic           |
| C.2             | 833                 | 1.00                   | 896                          | 598              | 643                       | 896                     | SW-3            | 960                       | OK    | Seismic           |
| C.3             | 833                 | 1.00                   | 896                          | 598              | 643                       | 896                     | SW-3            | 960                       | OK    | Seismic           |
| D.1             | 298                 | 1.00                   | 321                          | 481              | 517                       | 517                     | SW-6            | 696                       | OK    | Wind              |

\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

## Determine Shear Wall Overturning Moment Lever Arm

| SW Segment Mark | Wall Length Lever Arm (ft) | Calculated Lever Arm (ft) | % Different | Override Wall Length | User Input $M_{OT}$ Lever Arm (ft) |
|-----------------|----------------------------|---------------------------|-------------|----------------------|------------------------------------|
| A.1             | 17.00                      | 16.63                     | 2.26%       | No                   |                                    |
| B.1             | 15.75                      | 15.27                     | 3.17%       | No                   |                                    |
| C.1             | 11.00                      | 10.52                     | 4.61%       | No                   |                                    |
| C.2             | 9.00                       | 8.51                      | 5.75%       | No                   |                                    |
| C.3             | 7.00                       | 6.51                      | 7.52%       | No                   |                                    |
| D.1             | 17.00                      | 16.63                     | 2.26%       | No                   |                                    |

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# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **Main Floor (E-W)**

## Shear Wall End Axial Load (ASD)

| SW Segment Mark | Seismic Tension (lb) | ASD Seismic Tension Above (lb) | Seismic Tension Total (lb) | Wind Tension (lb) | ASD Wind Tension Above (lb) | Wind Tension Total (lb) | End 1 Dead (lb) | End 2 Dead (lb) |
|-----------------|----------------------|--------------------------------|----------------------------|-------------------|-----------------------------|-------------------------|-----------------|-----------------|
| A.1             | 1009                 |                                | 1009                       | 838               |                             | 838                     | 4794            | 4794            |
| B.1             | 5517                 |                                | 5517                       | 2515              |                             | 2515                    | 5292            | 5292            |
| C.1             | 5977                 |                                | 5977                       | 3675              |                             | 3675                    | 3696            | 3696            |
| C.2             | 5977                 |                                | 5977                       | 3675              |                             | 3675                    | 1271            | 1271            |
| C.3             | 5977                 |                                | 5977                       | 3675              |                             | 3675                    | 989             | 989             |
| D.1             | 2140                 |                                | 2140                       | 2957              | -4482                       | -1525                   | 4998            | 4998            |

## Determine Required Holddown (ASD)

| SW Segment Mark | Wind End 1 Eq. 16-15 | EQ End 1 Eq. 16-16 | Wind End 2 Eq. 16-15 | EQ End 2 Eq. 16-16 | Controlling Ten. Load (lb) | Holddown              | Holddown Capacity (lb) | Status |
|-----------------|----------------------|--------------------|----------------------|--------------------|----------------------------|-----------------------|------------------------|--------|
| A.1             | 2038                 | 1217               | 2038                 | 1217               | 1217                       | No HD                 | 0                      | OK     |
| B.1             | 660                  | -3060              | 660                  | -3060              | -3060                      | HDU5 (5645DF, 4340HF) | -4340                  | OK     |
| C.1             | -1458                | -4261              | -1458                | -4261              | -4261                      | HDU5 (5645DF, 4340HF) | -4340                  | OK     |
| C.2             | -2913                | -5386              | -2913                | -5386              | -5386                      | HDU8 (6765DF, 5820HF) | -5820                  | OK     |
| C.3             | -3082                | -5518              | -3082                | -5518              | -5518                      | HDU8 (6765DF, 5820HF) | -5820                  | OK     |
| D.1             | 4523                 | 180                | 4523                 | 180                | 180                        | No HD                 | 0                      | OK     |



**Quantum Consulting Engineers LLC**  
 1511 Third Avenue, Suite 323  
 Seattle, WA 98101

Project: Hong Kao Residence

Date: 10/12/23

Job No: 23127.01

Designer: MKS

Sheet: 3

Client: Chesmore Buck

Checked By: SHT

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **Main Floor Continued (E-W)**


Sds = 0.97  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

### Shear Wall Line Information

| SW Mark          | L <sub>sw</sub> (ft) | Wall Pier h <sub>wp</sub> (ft) | Aspect Ratio | Wall Framing Species | Specific Gravity G | Interstory or Base? | h <sub>sw</sub> (ft) | Wall Wt. (psf) | Roof/Floor Trib. (ft) | Roof/Floor Wt. (psf) |
|------------------|----------------------|--------------------------------|--------------|----------------------|--------------------|---------------------|----------------------|----------------|-----------------------|----------------------|
| <b>SW GRID</b> E | <b>20.50</b>         | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| SW Segment E.1   | 6.50                 | 10.50                          | 1.62         | HF #2                | 0.43               | Base                | 10.50                | 48.0           | 2.0                   | 12.0                 |
| E.2              | 14.00                | 10.50                          | 0.75         | HF #2                | 0.43               | Base                | 10.50                | 48.0           | 6.0                   | 12.0                 |
| <b>SW GRID</b>   | <b>0.00</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| <b>SW GRID</b>   | <b>0.00</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| <b>SW GRID</b>   | <b>0.00</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| <b>SW GRID</b>   | <b>0.00</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |

### Shear Wall Loads and Summary

| SW Mark          | EQ (lb) Wall (UJT) | Wind (lb) Wall (UJT) | Wall DL (lb) | Wall DL (lb) End 1 | Wall DL (lb) End 2 | Shear Wall Type | MIN. # of End Studs | Holddown              |
|------------------|--------------------|----------------------|--------------|--------------------|--------------------|-----------------|---------------------|-----------------------|
| <b>SW GRID</b> E | 14880              | 8496                 | -            | -                  | -                  | -               | -                   | -                     |
| SW Segment E.1   | 4718               | 2694                 | 3432         | -                  | -                  | SW-3            | 2                   | HDU8 (6765DF, 5820HF) |
| E.2              | 10162              | 5802                 | 8064         | -                  | -                  | SW-3            | 2                   | HDU5 (5645DF, 4340HF) |
| <b>SW GRID</b>   |                    |                      |              |                    |                    |                 |                     |                       |
| <b>SW GRID</b>   |                    |                      |              |                    |                    |                 |                     |                       |
| <b>SW GRID</b>   |                    |                      |              |                    |                    |                 |                     |                       |
| <b>SW GRID</b>   |                    |                      |              |                    |                    |                 |                     |                       |

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|   |                             | Designer: MKS   | Sheet: 1         |
|   | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Koa and Hong Residence**  
 Floor Level: **Main Floor Continued (E-W)**

Shear Wall Schedule (LRFD)

$\phi_p = 0.8$

| Shear Wall Type | Sheathing Grade, Sheathing Thickness, & Nail Size | Panel Edge Nail Spacing (in) | Nominal Seismic SW Capacity (plf) | LRFD Seismic SW Capacity (plf) | Nominal Wind SW Capacity (plf) | LRFD Wind SW Capacity (plf) | Sheathing Shear Stiffness, $G_s$ (lb/in) |
|-----------------|---|------------------------------|-----------------------------------|--------------------------------|--------------------------------|-----------------------------|--|
| SW-6            | APA Rated, 15/32", 10d Common                     | 6                            | 620                               | 496                            | 870                            | 696                         | 14                                       |
| SW-4            | APA Rated, 15/32", 10d Common                     | 4                            | 920                               | 736                            | 1290                           | 1032                        | 17                                       |
| SW-3            | APA Rated, 15/32", 10d Common                     | 3                            | 1200                              | 960                            | 1680                           | 1344                        | 19                                       |
| SW-2            | APA Rated, 15/32", 10d Common                     | 2                            | 1540                              | 1232                           | 2155                           | 1724                        | 23                                       |
| 2SW-4           | APA Rated, 7/16", 8d Common                       | 4                            | 1520                              | 1216                           | 2130                           | 1704                        | 26                                       |
| 2SW-3           | APA Rated, 7/16", 8d Common                       | 3                            | 1960                              | 1568                           | 2740                           | 2192                        | 30                                       |
| 2SW-2           | APA Rated, 7/16", 8d Common                       | 2                            | 2560                              | 2048                           | 3580                           | 2864                        | 40                                       |

\*\*See SDPWS Table 4.3A Note 2


Determine Shear Wall Type (LRFD)

| SW Segment Mark | Seismic Shear (plf) | Aspect Ratio Reduction | Adjusted Seismic Shear (plf) | Wind Shear (plf) | Adjusted Wind Shear (plf) | Controlling Shear (plf) | Shear Wall Type | Shear Wall Capacity (plf) | Check | Controlling Shear |
|-----------------|---------------------|------------------------|------------------------------|------------------|---------------------------|-------------------------|-----------------|---------------------------|-------|-------------------|
| E.1             | 726                 | 1.00                   | 780                          | 414              | 446                       | 780                     | SW-3            | 960                       | OK    | Seismic           |
| E.2             | 726                 | 1.00                   | 780                          | 414              | 446                       | 780                     | SW-3            | 960                       | OK    | Seismic           |
|                 |                     |                        |                              |                  |                           |                         |                 |                           |       |                   |
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|                 |                     |                        |                              |                  |                           |                         |                 |                           |       |                   |

\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

| SW Segment Mark | Wall Length Lever Arm (ft) | Calculated Lever Arm (ft) | % Different | Override Wall Length | User Input $M_{OT}$ Lever Arm (ft) |
|-----------------|----------------------------|---------------------------|-------------|----------------------|------------------------------------|
| E.1             | 6.50                       | 6.01                      | 8.15%       | No                   |                                    |
| E.2             | 14.00                      | 13.52                     | 3.58%       | No                   |                                    |
|                 |                            |                           |             |                      |                                    |
|                 |                            |                           |             |                      |                                    |
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|   |                             |                |                  |
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|   | Client: Chesmore Buck       | Designer: MKS  | Sheet: 3         |
|   | Checked By: SHT             |                |                  |



# Wood Framed Diaphragm Design

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

---

Structure: **Hong and Kao Residence**

Level: **High Roof (N-S)**

Diaphragm: **High Roof along Grid 3**

Species: **HF #2**

Length: **31.5 ft**

Wind: **2264 lb** (ULT)

Seismic: **9414 lb** (ULT)

$v_{u,w}$ : 72 plf

$v_{u,s}$ : 299 plf ( $\Omega=1.0$ )

Controlling Shear: Seismic

Diaphragm Type: **Unblocked, 8d nails @ 6" o.c.**

$\Phi_{v,w}$ : 498 plf (ULT)

$\Phi_{v,s}$ : 357 plf (ULT)

**OK**

# Wood Framed Diaphragm Design

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

---

Structure: **Hong and Kao Residence**

Level: **Low Roof (N-S)**

Diaphragm: **Office Roof along Grid 2**

Species: **HF #2**

Length: **14.5 ft**

Wind: **1836 lb** (ULT)

Seismic: **3153 lb** (ULT)

$v_{u,w}$ : 127 plf

$v_{u,s}$ : 217 plf ( $\Omega=1.0$ )

Controlling Shear: Seismic

Diaphragm Type: **Unblocked, 8d nails @ 6" o.c.**

$\Phi_{v,w}$ : 498 plf (ULT)

$\Phi_{v,s}$ : 357 plf (ULT)

**OK**



# Wood Framed Diaphragm Design

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

---

Structure: **Hong and Kao Residence**

Level: **Low Roof (N-S)**

Diaphragm: **Living Room Roof along Grid 3**

Species: **HF #2**

Length: **16.5 ft**

Wind: **4427 lb** (ULT)

Seismic: **5522 lb** (ULT)

$v_{u,w}$ : 268 plf

$v_{u,s}$ : 335 plf ( $\Omega=1.0$ )

Controlling Shear: Seismic

Diaphragm Type: **Unblocked, 8d nails @ 6" o.c.**

$\Phi_{v,w}$ : 498 plf (ULT)

$\Phi_{v,s}$ : 357 plf (ULT)

**OK**

# Wood Framed Diaphragm Design

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

---

Structure: **Hong and Kao Residence**

Level: **Upper Floor (N-S)**

Diaphragm: **Upper Floor along Grid 3**

Species: **HF #2**

Length: **31.5 ft**

Wind: **2998 lb** (ULT)

Seismic: **6203 lb** (ULT)

$v_{u,w}$ : 95 plf

$v_{u,s}$ : 197 plf ( $\Omega=1.0$ )

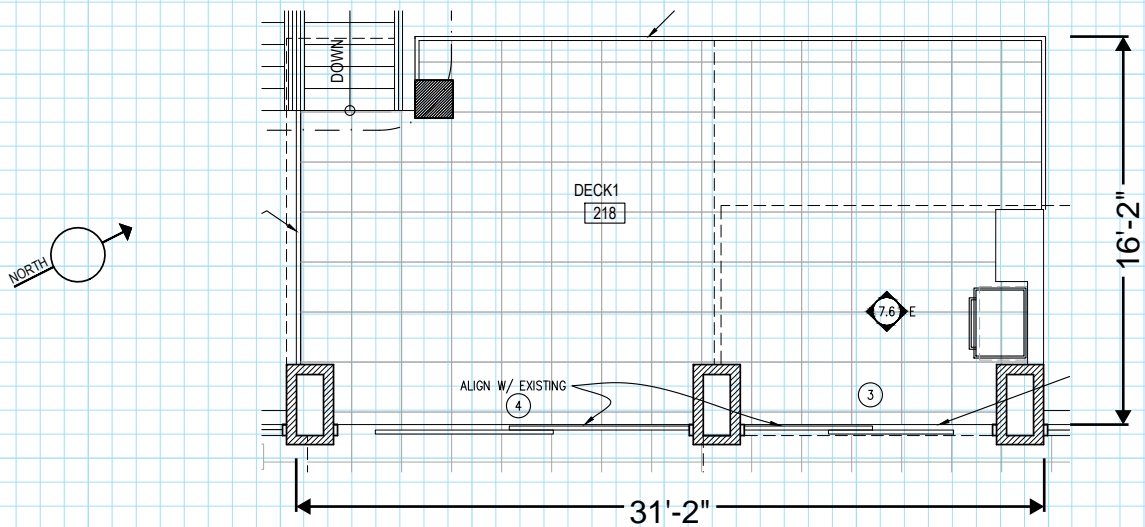
Controlling Shear: Seismic

Diaphragm Type: **Unblocked, 8d nails @ 6" o.c.**

$\Phi_{v,w}$ : 498 plf (ULT)

$\Phi_{v,s}$ : 357 plf (ULT)

**OK**



## Main Floor Deck

### Diaphragm Design:

N-S Direction:

$V_e = 883 \text{ lb (ULT)}$

Diaphragm Length = 31.25'

$v_u = 28 \text{ plf}$

Diaphragm Type: Unblocked, 8d nails @ 6" o.c.

$\phi v_n = 353 \text{ plf}$

*Unblocked diaphragm OK.*

E-W Direction:

$V_e = 883 \text{ lb} \cdot 16.25' / 31.25' = 459 \text{ lb (ULT)}$

Diaphragm Length = 16.25'

$v_u = 28 \text{ plf}$

Diaphragm Type: Unblocked, 8d nails @ 6" o.c.

$\phi v_n = 353 \text{ plf}$

*Unblocked diaphragm OK.*

### Connection Design:

$V_e = 883 \cdot 0.7 = 618 \text{ lb (ASD)}$

Moment Arm = 16.25'

Chord Spacing = 31.25'

Chord Force = 321 lb (ASD)

Strap: CS16

Allowable Tension = 1705 lb

*CS16 strap OK.*

*Note: At main floor deck, chord force on the north side is resisted by the continuous HSS beam dragging the load into the floor diaphragm. See detail 12/S6.0.*



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project \_\_\_\_\_

client \_\_\_\_\_

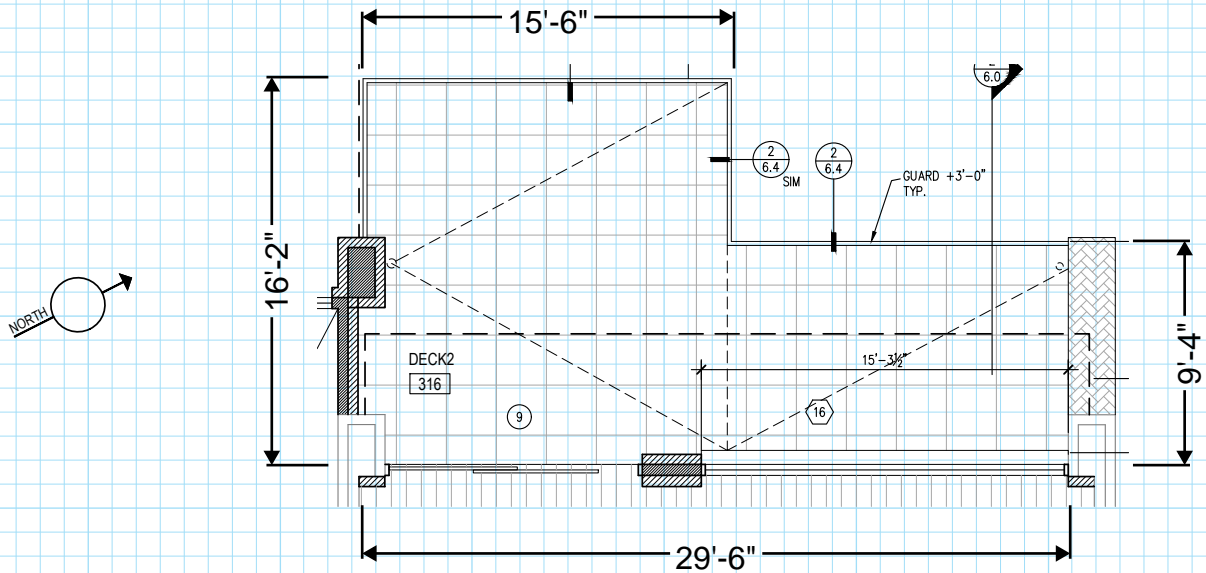
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## Upper Floor Deck

### Diaphragm Design:

#### N-S Direction:

$V_e = 1388 \text{ lb (ULT)}$

Diaphragm Length = 15.5'

$v_u = 90 \text{ plf}$

Diaphragm Type: Unblocked, 8d nails @ 6" o.c.

$\phi \cdot v_n = 353 \text{ plf}$

*Unblocked diaphragm OK.*

#### E-W Direction:

$V_e = 1388 \text{ lb} \cdot 16.25' / 29.5' = 765 \text{ lb (ULT)}$

Diaphragm Length = 9.33'

$v_u = 82 \text{ plf}$

Diaphragm Type: Unblocked, 8d nails @ 6" o.c.

$\phi \cdot v_n = 353 \text{ plf}$

*Unblocked diaphragm OK.*

### Connection Design:

$V_e = 1388 \cdot 0.7 = 972 \text{ lb (ASD)}$

Moment Arm = 16.25'

Chord Spacing = 15.5'

Chord Force = 1019 lb (ASD)

Strap: CS16

Allowable Tension = 1705 lb

*CS16 strap OK.*

*Note: At upper floor deck, chord forces are resisted by bolted connection between HSS and W10 beam. See detail 4/S5.0.*



**QUANTUM**

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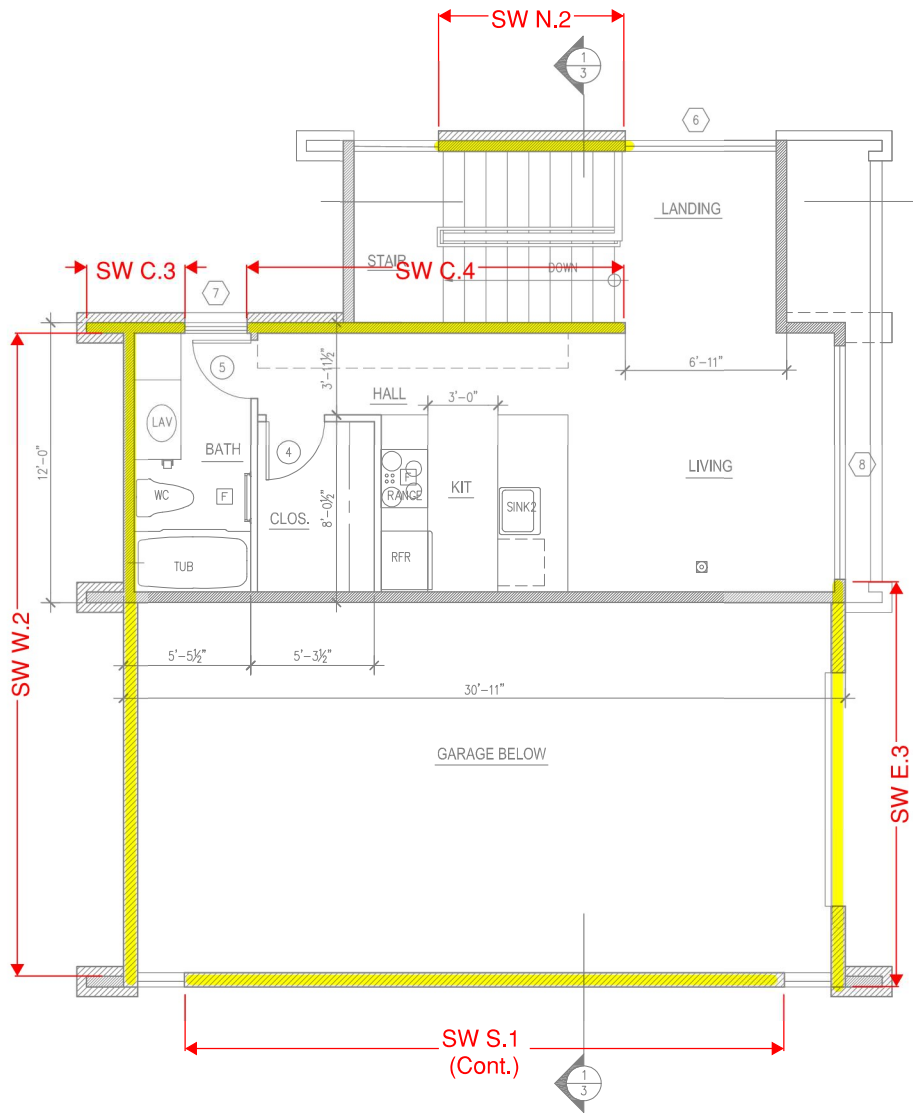


**HONG AND KAO RESIDENCE**

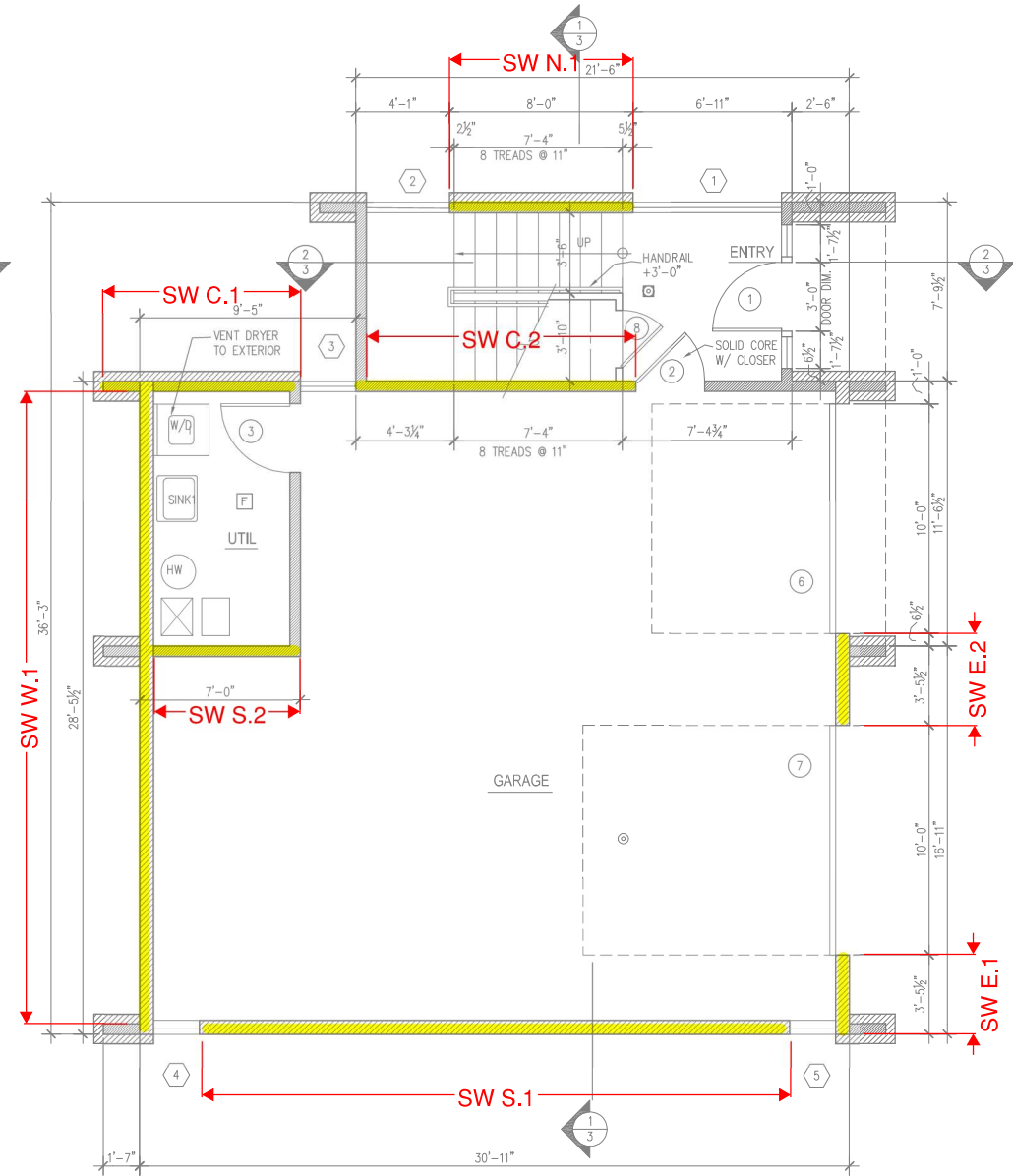
5425 W. Mercer Way  
Mercer Island, WA 98040

Quantum Job Number: 23127.01

**LATERAL DESIGN – DADU**



**DADU Upper Floor Shear Wall Key Plan**



**DADU Main Floor Shear Wall Key Plan**

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2021, ASCE 7-16, SDPWS 2021 & NDS 2018

Structure: **Hong and Kao Residence**  
 Floor Level: **DADU Roof (N-S)**


Sds = 0.97  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

## Shear Wall Line Information

| SW Mark          | L <sub>sw</sub> (ft) | Wall Pier<br>h <sub>wp</sub> (ft) | Aspect<br>Ratio | Wall Framing<br>Species | Specific<br>Gravity G | Interstory or<br>Base? | h <sub>sw</sub> (ft) | Wall Wt.<br>(psf) | Roof/Floor<br>Trib. (ft) | Roof/Floor<br>Wt. (psf) |
|------------------|----------------------|-----------------------------------|-----------------|-------------------------|-----------------------|------------------------|----------------------|-------------------|--------------------------|-------------------------|
| <b>SW GRID N</b> | <b>8.00</b>          | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| SW Segment N.2   | 8.00                 | 11.00                             | 1.38            | HF #2                   | 0.43                  | Interstory             | 11.00                | 10.0              | 4.0                      | 15.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID C</b> | <b>20.50</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| SW Segment C.3   | 4.25                 | 11.00                             | 2.59            | HF #2                   | 0.43                  | Interstory             | 11.00                | 10.0              | 18.0                     | 15.0                    |
| SW Segment C.4   | 16.25                | 11.00                             | 0.68            | HF #2                   | 0.43                  | Interstory             | 11.00                | 10.0              | 18.0                     | 15.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID S</b> | <b>25.67</b>         | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
| SW Segment S.1   | 25.67                | 21.00                             | 0.82            | HF #2                   | 0.43                  | Base                   | 21.00                | 10.0              | 14.0                     | 15.0                    |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
| <b>SW GRID</b>   | <b>0.00</b>          | -                                 | -               | -                       | -                     | -                      | -                    | -                 | -                        | -                       |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |
|                  |                      |                                   |                 |                         |                       |                        |                      |                   |                          |                         |

## Shear Wall Loads and Summary

| SW Mark          | EQ (lb) Wall<br>(ULT) | Wind (lb) Wall<br>(ULT) | Wall DL (lb) | Wall DL (lb)<br>End 1 | Wall DL (lb)<br>End 2 | Shear Wall Type | MIN. # of<br>End Studs | Holddown             |
|------------------|-----------------------|-------------------------|--------------|-----------------------|-----------------------|-----------------|------------------------|----------------------|
| <b>SW GRID N</b> | 490                   | 482                     | -            | -                     | -                     | -               | -                      | -                    |
| SW Segment N.2   | 490                   | 482                     | 1360         |                       |                       | SW-6            | 2                      | CS16 (1705)          |
|                  |                       |                         |              |                       |                       |                 |                        |                      |
|                  |                       |                         |              |                       |                       |                 |                        |                      |
| <b>SW GRID C</b> | 3430                  | 2054                    |              |                       |                       |                 |                        |                      |
| SW Segment C.3   | 711                   | 426                     | 1615         |                       |                       | SW-6            | 2                      | CS16 (1705)          |
| SW Segment C.4   | 2719                  | 1628                    | 6175         |                       |                       | SW-6            | 2                      | CS16 (1705)          |
|                  |                       |                         |              |                       |                       |                 |                        |                      |
|                  |                       |                         |              |                       |                       |                 |                        |                      |
| <b>SW GRID S</b> | 2940                  | 1586                    |              |                       |                       |                 |                        |                      |
| SW Segment S.1   | 2940                  | 1586                    | 10780        |                       |                       | SW-6            | 2                      | HDU2 (3075DF,2215HF) |
|                  |                       |                         |              |                       |                       |                 |                        |                      |
|                  |                       |                         |              |                       |                       |                 |                        |                      |
| <b>SW GRID</b>   |                       |                         |              |                       |                       |                 |                        |                      |
|                  |                       |                         |              |                       |                       |                 |                        |                      |
|                  |                       |                         |              |                       |                       |                 |                        |                      |

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|   |                             | Designer: MKS   | Sheet: 1         |
|   | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2021, ASCE 7-16, SDPWS 2021 & NDS 2018

Structure: **Hong and Kao Residence**  
 Floor Level: **DADU Roof (N-S)**

EQ  $\phi$  SDPWS 4.1.4.1    WIND  $\phi$  SDPWS 4.1.4.2  
 $\phi_D = 0.5$      $\phi_D = 0.8$

### Shear Wall Schedule (LRFD)

| Shear Wall Type | Sheathing Grade, Sheathing Thickness, & Nail Size | Panel Edge Nail Spacing (in) | Nominal Seismic SW Capacity (plf) | LRFD Seismic SW Capacity (plf) | Nominal Wind SW Capacity (plf) | LRFD Wind SW Capacity (plf) | Sheathing Shear Stiffness, $G_s$ (lb/in) |
|-----------------|---|------------------------------|-----------------------------------|--------------------------------|--------------------------------|-----------------------------|--|
| SW-6            | APA Rated, 15/32", 10d Common                     | 6                            | 870                               | 435                            | 870                            | 696                         | 14                                       |
| SW-4            | APA Rated, 15/32", 10d Common                     | 4                            | 1290                              | 645                            | 1290                           | 1032                        | 17                                       |
| SW-3            | APA Rated, 15/32", 10d Common                     | 3                            | 1680                              | 840                            | 1680                           | 1344                        | 19                                       |
| SW-2            | APA Rated, 15/32", 10d Common                     | 2                            | 2155                              | 1078                           | 2155                           | 1724                        | 23                                       |
| 2SW-4           | APA Rated, 15/32", 10d Common                     | 4                            | 2580                              | 1290                           | 2580                           | 2064                        | 34                                       |
| 2SW-3           | APA Rated, 15/32", 10d Common                     | 3                            | 3360                              | 1680                           | 3360                           | 2688                        | 38                                       |
| 2SW-2           | APA Rated, 15/32", 10d Common                     | 2                            | 4310                              | 2155                           | 4310                           | 3448                        | 46                                       |


### Determine Shear Wall Type (LRFD)

| SW Segment Mark | Seismic Shear (plf) | Aspect Ratio Reduction | Adjusted Seismic Shear (plf) | Wind Shear (plf) | Adjusted Wind Shear (plf) | Controlling Shear (plf) | Shear Wall Type | Shear Wall Capacity (plf) | Check | Controlling Shear |
|-----------------|---------------------|------------------------|------------------------------|------------------|---------------------------|-------------------------|-----------------|---------------------------|-------|-------------------|
| N.2             | 61                  | 1.00                   | 66                           | 60               | 65                        | 66                      | SW-6            | 435                       | OK    | Seismic           |
| C.3             | 167                 | 0.93                   | 194                          | 100              | 116                       | 194                     | SW-6            | 435                       | OK    | Seismic           |
| C.4             | 167                 | 1.00                   | 180                          | 100              | 108                       | 180                     | SW-6            | 435                       | OK    | Seismic           |
| S.1             | 115                 | 1.00                   | 123                          | 62               | 66                        | 123                     | SW-6            | 435                       | OK    | Seismic           |

\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

### Determine Shear Wall Overturning Moment Lever Arm

| SW Segment Mark | Wall Length Lever Arm (ft) | Calculated Lever Arm (ft) | % Different | Override Wall Length | User Input $M_{OT}$ Lever Arm (ft) |
|-----------------|----------------------------|---------------------------|-------------|----------------------|------------------------------------|
| N.2             | 8.00                       | 7.79                      | 2.67%       | No                   |                                    |
| C.3             | 4.25                       | 4.04                      | 5.15%       | No                   |                                    |
| C.4             | 16.25                      | 16.04                     | 1.30%       | No                   |                                    |
| S.1             | 25.67                      | 25.18                     | 1.92%       | No                   |                                    |

|   |                             |                 |                  |
|---|-----------------------------|-----------------|------------------|
|  <b>Quantum Consulting Engineers LLC</b><br>1511 Third Avenue, Suite 323<br>Seattle, WA 98101 | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|   |                             | Designer: MKS   | Sheet: 3         |
|   | Client: Chesmore Buck       | Checked By: SHT |                  |



# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2021, ASCE 7-16, SDPWS 2021 & NDS 2018


Structure: **Hong and Kao Residence**  
 Floor Level: **DADU Roof (N-S)**

## Shear Wall End Axial Load (ASD)

| SW Segment Mark | Seismic Tension (lb) | ASD Seismic Tension Above (lb) | Seismic Tension Total (lb) | Wind Tension (lb) | ASD Wind Tension Above (lb) | Wind Tension Total (lb) | End 1 Dead (lb) | End 2 Dead (lb) |
|-----------------|----------------------|--------------------------------|----------------------------|-------------------|-----------------------------|-------------------------|-----------------|-----------------|
| N.2             | 472                  |                                | 472                        | 397               |                             | 397                     | 680             | 680             |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
| C.3             | 1288                 |                                | 1288                       | 661               |                             | 661                     | 808             | 808             |
| C.4             | 1288                 |                                | 1288                       | 661               |                             | 661                     | 3088            | 3088            |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
| S.1             | 1684                 |                                | 1684                       | 779               |                             | 779                     | 5390            | 5390            |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |

## Determine Required Holdown (ASD)

| SW Segment Mark | Wind End 1 Eq. 16-15 | EQ End 1 Eq. 16-16 | Wind End 2 Eq. 16-15 | EQ End 2 Eq. 16-16 | Controlling Ten. Load (lb) | Holdown              | Holdown Capacity (lb) | Status |
|-----------------|----------------------|--------------------|----------------------|--------------------|----------------------------|----------------------|-----------------------|--------|
| N.2             | 11                   | -156               | 11                   | -156               | -156                       | CS16 (1705)          | -1705                 | OK     |
|                 |                      |                    |                      |                    |                            |                      |                       |        |
|                 |                      |                    |                      |                    |                            |                      |                       |        |
| C.3             | -177                 | -913               | -177                 | -913               | -913                       | CS16 (1705)          | -1705                 | OK     |
| C.4             | 1191                 | 145                | 1191                 | 145                | 145                        | CS16 (1705)          | -1705                 | OK     |
|                 |                      |                    |                      |                    |                            |                      |                       |        |
| S.1             | 2455                 | 818                | 2455                 | 818                | 818                        | HDU2 (3075DF,2215HF) | -2215                 | OK     |
|                 |                      |                    |                      |                    |                            |                      |                       |        |
|                 |                      |                    |                      |                    |                            |                      |                       |        |
|                 |                      |                    |                      |                    |                            |                      |                       |        |
|                 |                      |                    |                      |                    |                            |                      |                       |        |

|   |                             |                 |                  |
|---|-----------------------------|-----------------|------------------|
|  <b>Quantum Consulting Engineers LLC</b><br>1511 Third Avenue, Suite 323<br>Seattle, WA 98101 | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|   |                             | Designer: MKS   | Sheet: 3         |
|   | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2021, ASCE 7-16, SDPWS 2021 & NDS 2018

Structure: **Hong and Kao Residence**  
 Floor Level: **DADU Upper Floor (N-S)**


Sds = 0.97  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

**Shear Wall Line Information**

| SW Mark          | L <sub>sw</sub> (ft) | Wall Pier h <sub>wp</sub> (ft) | Aspect Ratio | Wall Framing Species | Specific Gravity G | Interstory or Base? | h <sub>sw</sub> (ft) | Wall Wt. (psf) | Roof/Floor Trib. (ft) | Roof/Floor Wt. (psf) |
|------------------|----------------------|--------------------------------|--------------|----------------------|--------------------|---------------------|----------------------|----------------|-----------------------|----------------------|
| <b>SW GRID N</b> | <b>8.00</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| SW Segment N.1   | 8.00                 | 10.00                          | 1.25         | HF #2                | 0.43               | Base                | 10.00                | 10.0           | 4.0                   | 15.0                 |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
| <b>SW GRID C</b> | <b>20.50</b>         | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| SW Segment C.1   | 8.50                 | 10.00                          | 1.18         | HF #2                | 0.43               | Base                | 10.00                | 10.0           | 18.0                  | 15.0                 |
| SW Segment C.2   | 12.00                | 10.00                          | 0.83         | HF #2                | 0.43               | Base                | 10.00                | 10.0           | 18.0                  | 15.0                 |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
| <b>SW GRID S</b> | <b>6.33</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| SW Segment S.2   | 6.33                 | 10.00                          | 1.58         | HF #2                | 0.43               | Base                | 10.00                | 10.0           | 14.0                  | 15.0                 |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
| <b>SW GRID</b>   | <b>0.00</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |

**Shear Wall Loads and Summary**

| SW Mark          | EQ (lb) Wall (ULT) | Wind (lb) Wall (ULT) | Wall DL (lb) | Wall DL (lb) End 1 | Wall DL (lb) End 2 | Shear Wall Type | MIN. # of End Studs | Holddown              |
|------------------|--------------------|----------------------|--------------|--------------------|--------------------|-----------------|---------------------|-----------------------|
| <b>SW GRID N</b> | 1540               | 1357                 | -            | -                  | -                  | -               | -                   | -                     |
| SW Segment N.1   | 1540               | 1357                 | 1280         | 680                | 680                | SW-6            | 2                   | HDU2 (3075DF,2215HF)  |
|                  |                    |                      |              |                    |                    |                 |                     |                       |
| <b>SW GRID C</b> | 5390               | 5787                 | -            | -                  | -                  | -               | -                   | -                     |
| SW Segment C.1   | 2235               | 2400                 | 3145         | 808                | 808                | SW-6            | 2                   | HDU4 (4565DF, 3285HF) |
| SW Segment C.2   | 3155               | 3388                 | 4440         | 3088               | 3088               | SW-6            | 2                   | HDU2 (3075DF,2215HF)  |
|                  |                    |                      |              |                    |                    |                 |                     |                       |
| <b>SW GRID S</b> | 3850               | 4470                 | -            | -                  | -                  | -               | -                   | -                     |
| SW Segment S.2   | 3850               | 4470                 | 1963         | 5522               | 5522               | SW-3            | 2                   | HDU4 (4565DF, 3285HF) |
|                  |                    |                      |              |                    |                    |                 |                     |                       |
| <b>SW GRID</b>   |                    |                      |              |                    |                    |                 |                     |                       |
|                  |                    |                      |              |                    |                    |                 |                     |                       |
|                  |                    |                      |              |                    |                    |                 |                     |                       |

|  |   |                             |                 |                  |
|--|---|-----------------------------|-----------------|------------------|
|  | <b>Quantum Consulting Engineers LLC</b> | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|  | 1511 Third Avenue, Suite 323            |                             | Designer: MKS   | Sheet: 1         |
|  | Seattle, WA 98101                       | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2021, ASCE 7-16, SDPWS 2021 & NDS 2018

Structure: **Hong and Kao Residence**  
 Floor Level: **DADU Upper Floor (N-S)**

EQ  $\phi$  SDPWS 4.1.4.1    WIND  $\phi$  SDPWS 4.1.4.2  
 $\phi_D = 0.5$                        $\phi_D = 0.8$

Shear Wall Schedule (LRFD)

| Shear Wall Type | Sheathing Grade, Sheathing Thickness, & Nail Size | Panel Edge Nail Spacing (in) | Nominal Seismic SW Capacity (plf) | LRFD Seismic SW Capacity (plf) | Nominal Wind SW Capacity (plf) | LRFD Wind SW Capacity (plf) | Sheathing Shear Stiffness, $G_s$ (lb/in) |
|-----------------|---|------------------------------|-----------------------------------|--------------------------------|--------------------------------|-----------------------------|--|
| SW-6            | APA Rated, 15/32", 10d Common                     | 6                            | 870                               | 435                            | 870                            | 696                         | 14                                       |
| SW-4            | APA Rated, 15/32", 10d Common                     | 4                            | 1290                              | 645                            | 1290                           | 1032                        | 17                                       |
| SW-3            | APA Rated, 15/32", 10d Common                     | 3                            | 1680                              | 840                            | 1680                           | 1344                        | 19                                       |
| SW-2            | APA Rated, 15/32", 10d Common                     | 2                            | 2155                              | 1078                           | 2155                           | 1724                        | 23                                       |
| 2SW-4           | APA Rated, 15/32", 10d Common                     | 4                            | 2580                              | 1290                           | 2580                           | 2064                        | 34                                       |
| 2SW-3           | APA Rated, 15/32", 10d Common                     | 3                            | 3360                              | 1680                           | 3360                           | 2688                        | 38                                       |
| 2SW-2           | APA Rated, 15/32", 10d Common                     | 2                            | 4310                              | 2155                           | 4310                           | 3448                        | 46                                       |


Determine Shear Wall Type (LRFD)

| SW Segment Mark | Seismic Shear (plf) | Aspect Ratio Reduction | Adjusted Seismic Shear (plf) | Wind Shear (plf) | Adjusted Wind Shear (plf) | Controlling Shear (plf) | Shear Wall Type | Shear Wall Capacity (plf) | Check | Controlling Shear |
|-----------------|---------------------|------------------------|------------------------------|------------------|---------------------------|-------------------------|-----------------|---------------------------|-------|-------------------|
| N.1             | 193                 | 1.00                   | 207                          | 170              | 182                       | 207                     | SW-6            | 435                       | OK    | Seismic           |
| C.1             | 263                 | 1.00                   | 283                          | 282              | 304                       | 283                     | SW-6            | 435                       | OK    | Seismic           |
| C.2             | 263                 | 1.00                   | 283                          | 282              | 304                       | 283                     | SW-6            | 435                       | OK    | Seismic           |
| S.2             | 608                 | 1.00                   | 654                          | 706              | 759                       | 654                     | SW-3            | 840                       | OK    | Seismic           |

\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

| SW Segment Mark | Wall Length Lever Arm (ft) | Calculated Lever Arm (ft) | % Different | Override Wall Length | User Input $M_{OT}$ Lever Arm (ft) |
|-----------------|----------------------------|---------------------------|-------------|----------------------|------------------------------------|
| N.1             | 8.00                       | 7.52                      | 6.44%       | No                   |                                    |
| C.1             | 8.50                       | 8.02                      | 6.04%       | No                   |                                    |
| C.2             | 12.00                      | 11.52                     | 4.21%       | No                   |                                    |
| S.2             | 6.33                       | 5.85                      | 8.28%       | No                   |                                    |

|  |   |                             |                 |                  |
|--|---|-----------------------------|-----------------|------------------|
|  | <b>Quantum Consulting Engineers LLC</b> | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|  | 1511 Third Avenue, Suite 323            |                             | Designer: MKS   | Sheet: 3         |
|  | Seattle, WA 98101                       | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2021, ASCE 7-16, SDPWS 2021 & NDS 2018


Structure: **Hong and Kao Residence**  
 Floor Level: **DADU Upper Floor (N-S)**

**Shear Wall End Axial Load (ASD)**

| SW Segment Mark | Seismic Tension (lb) | ASD Seismic Tension Above (lb) | Seismic Tension Total (lb) | Wind Tension (lb) | ASD Wind Tension Above (lb) | Wind Tension Total (lb) | End 1 Dead (lb) | End 2 Dead (lb) |
|-----------------|----------------------|--------------------------------|----------------------------|-------------------|-----------------------------|-------------------------|-----------------|-----------------|
| N.1             | 1348                 | 472                            | 1819                       | 1018              | 397                         | 1415                    | 1320            | 1320            |
| C.1             | 1840                 | 1705                           | 3545                       | 1694              | 875                         | 2569                    | 2380            | 2380            |
| C.2             | 1840                 | 1288                           | 3128                       | 1694              | 661                         | 2355                    | 5308            | 5308            |
| S.2             | 4255                 |                                | 4255                       | 4235              |                             | 4235                    | 6504            | 6504            |

**Determine Required Holdown (ASD)**

| SW Segment Mark | Wind End 1 Eq. 16-15 | EQ End 1 Eq. 16-16 | Wind End 2 Eq. 16-15 | EQ End 2 Eq. 16-16 | Controlling Ten. Load (lb) | Holdown               | Holdown Capacity (lb) | Status |
|-----------------|----------------------|--------------------|----------------------|--------------------|----------------------------|-----------------------|-----------------------|--------|
| N.1             | -623                 | -1206              | -623                 | -1206              | -1206                      | HDU2 (3075DF,2215HF)  | -2215                 | OK     |
| C.1             | -1141                | -2440              | -1141                | -2440              | -2440                      | HDU4 (4565DF, 3285HF) | -3285                 | OK     |
| C.2             | 830                  | -665               | 830                  | -665               | -665                       | HDU2 (3075DF,2215HF)  | -2215                 | OK     |
| S.2             | -333                 | -1237              | -333                 | -1237              | -1237                      | HDU4 (4565DF, 3285HF) | -3285                 | OK     |

|  |   |                             |                 |                  |
|--|---|-----------------------------|-----------------|------------------|
|  | <b>Quantum Consulting Engineers LLC</b> | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|  | 1511 Third Avenue, Suite 323            |                             | Designer: MKS   | Sheet: 3         |
|  | Seattle, WA 98101                       | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2021, ASCE 7-16, SDPWS 2021 & NDS 2018

Structure: **Hong and Kao Residence**  
 Floor Level: **DADU Roof (E-W)**


Sds = 0.97  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

**Shear Wall Line Information**

| SW Mark          | L <sub>sw</sub> (ft) | Wall Pier h <sub>wp</sub> (ft) | Aspect Ratio | Wall Framing Species | Specific Gravity G | Interstory or Base? | h <sub>sw</sub> (ft) | Wall Wt. (psf) | Roof/Floor Trib. (ft) | Roof/Floor Wt. (psf) |
|------------------|----------------------|--------------------------------|--------------|----------------------|--------------------|---------------------|----------------------|----------------|-----------------------|----------------------|
| <b>SW GRID E</b> | <b>17.00</b>         | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| SW Segment E.3   | 17.00                | 7.00                           | 0.41         | HF #2                | 0.43               | Interstory          | 11.00                | 10.0           | 1.0                   | 15.0                 |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
| <b>SW GRID W</b> | <b>28.50</b>         | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| SW Segment W.2   | 28.50                | 11.00                          | 0.39         | HF #2                | 0.43               | Interstory          | 11.00                | 10.0           | 1.0                   | 15.0                 |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
| <b>SW GRID</b>   | <b>0.00</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |
| <b>SW GRID</b>   | <b>0.00</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
|                  |                      |                                |              |                      |                    |                     |                      |                |                       |                      |

**Shear Wall Loads and Summary**

| SW Mark          | EQ (lb) Wall (U/LT) | Wind (lb) Wall (U/LT) | Wall DL (lb) | Wall DL (lb) End 1 | Wall DL (lb) End 2 | Shear Wall Type | MIN. # of End Studs | Holddown    |
|------------------|---------------------|-----------------------|--------------|--------------------|--------------------|-----------------|---------------------|-------------|
| <b>SW GRID E</b> | <b>3425</b>         | <b>1935</b>           | -            | -                  | -                  | -               | -                   | -           |
| SW Segment E.3   | 3425                | 1935                  | 2125         |                    |                    | SW-6            | 2                   | CS16 (1705) |
|                  |                     |                       |              |                    |                    |                 |                     |             |
| <b>SW GRID W</b> | <b>3425</b>         | <b>1935</b>           | -            | -                  | -                  | -               | -                   | -           |
| SW Segment W.2   | 3425                | 1935                  | 3563         | 200                | 200                | SW-6            | 2                   | CS16 (1705) |
|                  |                     |                       |              |                    |                    |                 |                     |             |
| <b>SW GRID</b>   | -                   | -                     | -            | -                  | -                  | -               | -                   | -           |
|                  |                     |                       |              |                    |                    |                 |                     |             |
| <b>SW GRID</b>   | -                   | -                     | -            | -                  | -                  | -               | -                   | -           |
|                  |                     |                       |              |                    |                    |                 |                     |             |

|  |   |                             |                 |                  |
|--|---|-----------------------------|-----------------|------------------|
|  | <b>Quantum Consulting Engineers LLC</b> | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|  | 1511 Third Avenue, Suite 323            |                             | Designer: MKS   | Sheet: 1         |
|  | Seattle, WA 98101                       | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2021, ASCE 7-16, SDPWS 2021 & NDS 2018

Structure: **Hong and Kao Residence**  
 Floor Level: **DADU Roof (E-W)**

EQ  $\phi$  SDPWS 4.1.4.1    WIND  $\phi$  SDPWS 4.1.4.2  
 $\phi_D = 0.5$      $\phi_D = 0.8$

Shear Wall Schedule (LRFD)

| Shear Wall Type | Sheathing Grade, Sheathing Thickness, & Nail Size | Panel Edge Nail Spacing (in) | Nominal Seismic SW Capacity (plf) | LRFD Seismic SW Capacity (plf) | Nominal Wind SW Capacity (plf) | LRFD Wind SW Capacity (plf) | Sheathing Shear Stiffness, $G_s$ (lb/in) |
|-----------------|---|------------------------------|-----------------------------------|--------------------------------|--------------------------------|-----------------------------|--|
| SW-6            | APA Rated, 15/32", 10d Common                     | 6                            | 870                               | 435                            | 870                            | 696                         | 14                                       |
| SW-4            | APA Rated, 15/32", 10d Common                     | 4                            | 1290                              | 645                            | 1290                           | 1032                        | 17                                       |
| SW-3            | APA Rated, 15/32", 10d Common                     | 3                            | 1680                              | 840                            | 1680                           | 1344                        | 19                                       |
| SW-2            | APA Rated, 15/32", 10d Common                     | 2                            | 2155                              | 1078                           | 2155                           | 1724                        | 23                                       |
| 2SW-4           | APA Rated, 15/32", 10d Common                     | 4                            | 2580                              | 1290                           | 2580                           | 2064                        | 34                                       |
| 2SW-3           | APA Rated, 15/32", 10d Common                     | 3                            | 3360                              | 1680                           | 3360                           | 2688                        | 38                                       |
| 2SW-2           | APA Rated, 15/32", 10d Common                     | 2                            | 4310                              | 2155                           | 4310                           | 3448                        | 46                                       |


Determine Shear Wall Type (LRFD)

| SW Segment Mark | Seismic Shear (plf) | Aspect Ratio Reduction | Adjusted Seismic Shear (plf) | Wind Shear (plf) | Adjusted Wind Shear (plf) | Controlling Shear (plf) | Shear Wall Type | Shear Wall Capacity (plf) | Check | Controlling Shear |
|-----------------|---------------------|------------------------|------------------------------|------------------|---------------------------|-------------------------|-----------------|---------------------------|-------|-------------------|
| E.3             | 201                 | 1.00                   | 217                          | 114              | 122                       | 217                     | SW-6            | 435                       | OK    | Seismic           |
| W.2             | 120                 | 1.00                   | 129                          | 68               | 73                        | 129                     | SW-6            | 435                       | OK    | Seismic           |

\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

Determine Shear Wall Overturning Moment Lever Arm

| SW Segment Mark | Wall Length Lever Arm (ft) | Calculated Lever Arm (ft) | % Different | Override Wall Length | User Input $M_{OT}$ Lever Arm (ft) |
|-----------------|----------------------------|---------------------------|-------------|----------------------|------------------------------------|
| E.3             | 17.00                      | 16.79                     | 1.24%       | No                   |                                    |
| W.2             | 28.50                      | 28.29                     | 0.74%       | No                   |                                    |

|   |                             |                |                  |
|---|-----------------------------|----------------|------------------|
|  <b>Quantum Consulting Engineers LLC</b><br>1511 Third Avenue, Suite 323<br>Seattle, WA 98101 | Project: Hong Kao Residence | Date: 10/12/23 | Job No: 23127.01 |
|   | Client: Chesmore Buck       | Designer: MKS  | Sheet: 3         |
|   | Checked By: SHT             |                |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2021, ASCE 7-16, SDPWS 2021 & NDS 2018


Structure: **Hong and Kao Residence**  
 Floor Level: **DADU Roof (E-W)**

Shear Wall End Axial Load (ASD)

| SW Segment Mark | Seismic Tension (lb) | ASD Seismic Tension Above (lb) | Seismic Tension Total (lb) | Wind Tension (lb) | ASD Wind Tension Above (lb) | Wind Tension Total (lb) | End 1 Dead (lb) | End 2 Dead (lb) |
|-----------------|----------------------|--------------------------------|----------------------------|-------------------|-----------------------------|-------------------------|-----------------|-----------------|
| E.3             | 1551                 |                                | 1551                       | 751               |                             | 751                     | 1063            | 1063            |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
| W.2             | 925                  |                                | 925                        | 448               |                             | 448                     | 1981            | 1981            |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |

Determine Required Holdown (ASD)

| SW Segment Mark | Wind End 1 Eq. 16-15 | EQ End 1 Eq. 16-16 | Wind End 2 Eq. 16-15 | EQ End 2 Eq. 16-16 | Controlling Ten. Load (lb) | Holdown     | Holdown Capacity (lb) | Status |
|-----------------|----------------------|--------------------|----------------------|--------------------|----------------------------|-------------|-----------------------|--------|
| E.3             | -114                 | -1058              | -114                 | -1058              | -1058                      | CS16 (1705) | -1705                 | OK     |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |
| W.2             | 741                  | -6                 | 741                  | -6                 | -6                         | CS16 (1705) | -1705                 | OK     |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |
|                 |                      |                    |                      |                    |                            |             |                       |        |
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|  <b>Quantum Consulting Engineers LLC</b><br>1511 Third Avenue, Suite 323<br>Seattle, WA 98101 | Project: Hong Kao Residence | Date: 10/12/23  | Job No: 23127.01 |
|   |                             | Designer: MKS   | Sheet: 3         |
|   | Client: Chesmore Buck       | Checked By: SHT |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2021, ASCE 7-16, SDPWS 2021 & NDS 2018

Structure: **Hong and Kao Residence**  
 Floor Level: **DADU Upper Floor (E-W)**


Sds = 0.97  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 17.25

### Shear Wall Line Information

| SW Mark          | L <sub>sw</sub> (ft) | Wall Pier h <sub>wp</sub> (ft) | Aspect Ratio | Wall Framing Species | Specific Gravity G | Interstory or Base? | h <sub>sw</sub> (ft) | Wall Wt. (psf) | Roof/Floor Trib. (ft) | Roof/Floor Wt. (psf) |
|------------------|----------------------|--------------------------------|--------------|----------------------|--------------------|---------------------|----------------------|----------------|-----------------------|----------------------|
| <b>SW GRID E</b> | <b>7.50</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| SW Segment E.1   | 3.50                 | 12.00                          | 3.43         | HF #2                | 0.43               | Base                | 12.00                | 10.0           | 1.0                   | 15.0                 |
| SW Segment E.2   | 4.00                 | 12.00                          | 3.00         | HF #2                | 0.43               | Base                | 12.00                | 10.0           | 1.0                   | 15.0                 |
| <b>SW GRID W</b> | <b>28.50</b>         | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| SW Segment W.1   | 28.50                | 10.00                          | 0.35         | HF #2                | 0.43               | Base                | 10.00                | 10.0           | 0.0                   | 15.0                 |
| <b>SW GRID</b>   | <b>0.00</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |
| <b>SW GRID</b>   | <b>0.00</b>          | -                              | -            | -                    | -                  | -                   | -                    | -              | -                     | -                    |

### Shear Wall Loads and Summary

| SW Mark          | EQ (lb) Wall (UJT) | Wind (lb) Wall (UJT) | Wall DL (lb) | Wall DL (lb) End 1 | Wall DL (lb) End 2 | Shear Wall Type | MIN. # of End Studs | Holddown                         |
|------------------|--------------------|----------------------|--------------|--------------------|--------------------|-----------------|---------------------|----------------------------------|
| <b>SW GRID E</b> | <b>5390</b>        | <b>5452</b>          | -            | -                  | -                  | -               | -                   | -                                |
| SW Segment E.1   | 2515               | 2544                 | 473          | 400                | 400                | SW-2            | 4                   | HDU11 (4) Studs (9335DF, 8030HF) |
| SW Segment E.2   | 2875               | 2908                 | 540          | 400                | 400                | SW-2            | 4                   | HDU11 (4) Studs (9335DF, 8030HF) |
| <b>SW GRID W</b> | <b>5390</b>        | <b>5452</b>          | -            | -                  | -                  | -               | -                   | -                                |
| SW Segment W.1   | 5390               | 5452                 | 2850         | 1981               | 1981               | SW-6            | 2                   | HDU2 (3075DF, 2215HF)            |
| <b>SW GRID</b>   | -                  | -                    | -            | -                  | -                  | -               | -                   | -                                |
| <b>SW GRID</b>   | -                  | -                    | -            | -                  | -                  | -               | -                   | -                                |

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|   |                             | Designer: MKS   | Sheet: 1         |
|   | Client: Chesmore Buck       | Checked By: SHT |                  |



# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2021, ASCE 7-16, SDPWS 2021 & NDS 2018

Structure: **Hong and Kao Residence**  
 Floor Level: **DADU Upper Floor (E-W)**

EQ  $\phi$  SDPWS 4.1.4.1    WIND  $\phi$  SDPWS 4.1.4.2  
 $\phi_D = 0.5$                        $\phi_D = 0.8$

**Shear Wall Schedule (LRFD)**

| Shear Wall Type | Sheathing Grade, Sheathing Thickness, & Nail Size | Panel Edge Nail Spacing (in) | Nominal Seismic SW Capacity (plf) | LRFD Seismic SW Capacity (plf) | Nominal Wind SW Capacity (plf) | LRFD Wind SW Capacity (plf) | Sheathing Shear Stiffness, G <sub>s</sub> (lb/in) |
|-----------------|---|------------------------------|-----------------------------------|--------------------------------|--------------------------------|-----------------------------|---|
| SW-6            | APA Rated, 15/32", 10d Common                     | 6                            | 870                               | 435                            | 870                            | 696                         | 14  |
| SW-4            | APA Rated, 15/32", 10d Common                     | 4                            | 1290                              | 645                            | 1290                           | 1032                        | 17  |
| SW-3            | APA Rated, 15/32", 10d Common                     | 3                            | 1680                              | 840                            | 1680                           | 1344                        | 19  |
| SW-2            | APA Rated, 15/32", 10d Common                     | 2                            | 2155                              | 1078                           | 2155                           | 1724                        | 23  |
| 2SW-4           | APA Rated, 15/32", 10d Common                     | 4                            | 2580                              | 1290                           | 2580                           | 2064                        | 34  |
| 2SW-3           | APA Rated, 15/32", 10d Common                     | 3                            | 3360                              | 1680                           | 3360                           | 2688                        | 38  |
| 2SW-2           | APA Rated, 15/32", 10d Common                     | 2                            | 4310                              | 2155                           | 4310                           | 3448                        | 46  |


**Determine Shear Wall Type (LRFD)**

| SW Segment Mark | Seismic Shear (plf) | Aspect Ratio Reduction | Adjusted Seismic Shear (plf) | Wind Shear (plf) | Adjusted Wind Shear (plf) | Controlling Shear (plf) | Shear Wall Type | Shear Wall Capacity (plf) | Check | Controlling Shear |
|-----------------|---------------------|------------------------|------------------------------|------------------|---------------------------|-------------------------|-----------------|---------------------------|-------|-------------------|
| E.1             | 719                 | 0.82                   | 941                          | 727              | 952                       | 941                     | SW-2            | 1078                      | OK    | Seismic           |
| E.2             | 719                 | 0.88                   | 883                          | 727              | 893                       | 883                     | SW-2            | 1078                      | OK    | Seismic           |
|                 |                     |                        |                              |                  |                           |                         |                 |                           |       |                   |
|                 |                     |                        |                              |                  |                           |                         |                 |                           |       |                   |
| W.1             | 189                 | 1.00                   | 203                          | 191              | 206                       | 203                     | SW-6            | 435                       | OK    | Seismic           |
|                 |                     |                        |                              |                  |                           |                         |                 |                           |       |                   |
|                 |                     |                        |                              |                  |                           |                         |                 |                           |       |                   |
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\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

**Determine Shear Wall Overturning Moment Lever Arm**

| SW Segment Mark | Wall Length Lever Arm (ft) | Calculated Lever Arm (ft) | % Different | Override Wall Length | User Input M <sub>OT</sub> Lever Arm (ft) |
|-----------------|----------------------------|---------------------------|-------------|----------------------|---|
| E.1             | 3.50                       | 2.76                      | 26.79%      | No                   |   |
| E.2             | 4.00                       | 3.26                      | 22.68%      | No                   |   |
|                 |                            |                           |             |                      |   |
|                 |                            |                           |             |                      |   |
| W.1             | 28.50                      | 28.02                     | 1.73%       | No                   |   |
|                 |                            |                           |             |                      |   |
|                 |                            |                           |             |                      |   |
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|  | 1511 Third Avenue, Suite 323            | Client: Chesmore Buck       | Designer: MKS  | Sheet: 3         |
|  | Seattle, WA 98101                       | Checked By: SHT             |                |                  |

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2021, ASCE 7-16, SDPWS 2021 & NDS 2018


Structure: **Hong and Kao Residence**  
 Floor Level: **DADU Upper Floor (E-W)**

**Shear Wall End Axial Load (ASD)**

| SW Segment Mark | Seismic Tension (lb) | ASD Seismic Tension Above (lb) | Seismic Tension Total (lb) | Wind Tension (lb) | ASD Wind Tension Above (lb) | Wind Tension Total (lb) | End 1 Dead (lb) | End 2 Dead (lb) |
|-----------------|----------------------|--------------------------------|----------------------------|-------------------|-----------------------------|-------------------------|-----------------|-----------------|
| E.1             | 6037                 | 1551                           | 7588                       | 5234              | 751                         | 5985                    | 636             | 636             |
| E.2             | 6037                 | 1551                           | 7588                       | 5234              | 751                         | 5985                    | 670             | 670             |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
| W.1             | 1324                 | 925                            | 2249                       | 1148              | 448                         | 1596                    | 3406            | 3406            |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |
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|                 |                      |                                |                            |                   |                             |                         |                 |                 |
|                 |                      |                                |                            |                   |                             |                         |                 |                 |

**Determine Required Holdown (ASD)**

| SW Segment Mark | Wind End 1 Eq. 16-15 | EQ End 1 Eq. 16-16 | Wind End 2 Eq. 16-15 | EQ End 2 Eq. 16-16 | Controlling Ten. Load (lb) | Holdown                         | Holdown Capacity (lb) | Status |
|-----------------|----------------------|--------------------|----------------------|--------------------|----------------------------|---------------------------------|-----------------------|--------|
| E.1             | -5603                | -7293              | -5603                | -7293              | -7293                      | HDU11 (4) Studs (9335DF, 8030H) | -8030                 | OK     |
| E.2             | -5583                | -7277              | -5583                | -7277              | -7277                      | HDU11 (4) Studs (9335DF, 8030H) | -8030                 | OK     |
|                 |                      |                    |                      |                    |                            |                                 |                       |        |
|                 |                      |                    |                      |                    |                            |                                 |                       |        |
| W.1             | 448                  | -668               | 448                  | -668               | -668                       | HDU2 (3075DF,2215HF)            | -2215                 | OK     |
|                 |                      |                    |                      |                    |                            |                                 |                       |        |
|                 |                      |                    |                      |                    |                            |                                 |                       |        |
|                 |                      |                    |                      |                    |                            |                                 |                       |        |
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