PRCTI20230167 - REVISION

City of Puyallup Building REVIEWED FOR COMPLIANCE
RayC
07/09/2024
10:44:54 AM

Approval of submitted plans is not an approval of omissions or oversight by this office or noncompliance with any applicable regulations of local government. The contractor is responsible for making sure that the building complies with all applicable building codes and regulations of the local government.

City of Puyallup
Development & Permitting Services
ISSUED PERMIT
Building | Planning
Engineering | Public Works
Fire | Traffic

CONSULTING ENGINEER
R.T. WHARTON &ASSOCIATES, INC
1268 HIDDEN CREST CT.
MESQUITE, NV 89034
725-225-1048

If deviations from plans are required please provide engineering approval for inspection review.

MANUFACTURER
PANEL-BUILT, INC.
302 BEASLEY ST.
BLAIRSVILLE, GA 30512
800-636-3873

THE APPROVED CONSTRUCTION PLANS AND ALL ENGINEERING MUST BE POSTED ON THE JOB AT ALL INSPECTIONS IN A VISIBLE AND READILY ACCESSIBLE LOCATION.
PRINT in COLOR and to SCALE.

STRUCTURAL DESIGN FOR

# REDDOT

MODULAR OFFICE #2 & #6 APROXIMATELY 830 & 2022 SQ. FT.
2504 E. MAIN AVE.
PUYALLUP, WA 98372

MATHCAD DEFINED UNITS ARE

$in \equiv 1L$ $lb \equiv 1M$ $si \equiv in^2$ $ci \equiv in^3$ $ft \equiv 12 \cdot in$ $sf \equiv ft^2$ $psf \equiv \frac{lb}{ft^2}$ $plf \equiv \frac{lb}{ft}$ $ksi := 1000 \cdot psi$

$psi \equiv \frac{lb}{in^2}$ $pcf := \frac{lb}{ft^3}$ $pli := \frac{lb}{in}$

**BUILDING CODE: 2018 WSBC**

**PROPOSED: ADD BEAM SUPPORTS FOR HVAC EQUIPMENT AT EXISTING OFFICES**

**DESIGN LOADS**

$LL_r := 20 \cdot psf$ ROOF LIVE LOAD (AT HVAC AREAS ONLY)

$DL_r := 9 \cdot psf$ ROOF DEAD LOAD.

**NO WIND LOAD, STRUCTURE IS INTERIOR TO A BUILDING**

**SEISMIC**

SITE CLASS "D" IN LIEU OF A SOILS REPORT.
SEISMIC FORCE-RESISTING SYSTEM A.17 (SHEAR WALLS NOT RATED FOR RESISTANCE)

$I := 1.0$ IMPORTANCE FACTOR PER TABLE 11.5-1 (CATEGORY II)

$R := 2$ RESPONSE MODIFICATION COEFF.

$\Omega_o := 2.5$ SYSTEM OVERSTRENGTH FACTOR

$C_d := 2$ DEFLECTION AMPLIFICATION FACTOR

$S_S := 1.266$ $S_1 := 0.435$ MAX. GROUND MOTION

$F_a := 1.2$ $F_v := 2.4$ SITE COEFFICIENTS

$S_{ms} := F_a \cdot S_S \cdot I$ $S_{ms} = 1.52$ $S_{ds} := \frac{2}{3} \cdot S_{ms}$ $S_{ds} = 1.01$

$S_{m1} := F_v \cdot S_1 \cdot I$ $S_{m1} = 1.04$ $S_{d1} := \frac{2}{3} \cdot S_{m1}$ $S_{d1} = 0.7$

DESIGN CAT. D $P := 1.0$ REDUNDANCY FACTOR, REGULAR IN PLAN

THEREFORE $C_s := \frac{S_{ds}}{\frac{R}{I}}$ $C_s = 0.51$

$Q_e := C_s$ $Q_e = 0.51$ HORIZONTAL SEISMIC FORCE FACTOR

RONALD T. WHARTON
STATE OF WASHINGTON
21705
REGISTERED
PROFESSIONAL ENGINEER
EXP.11/30/24

JUNE 30, 2024

## ALLOWABLE STRESS DESIGN

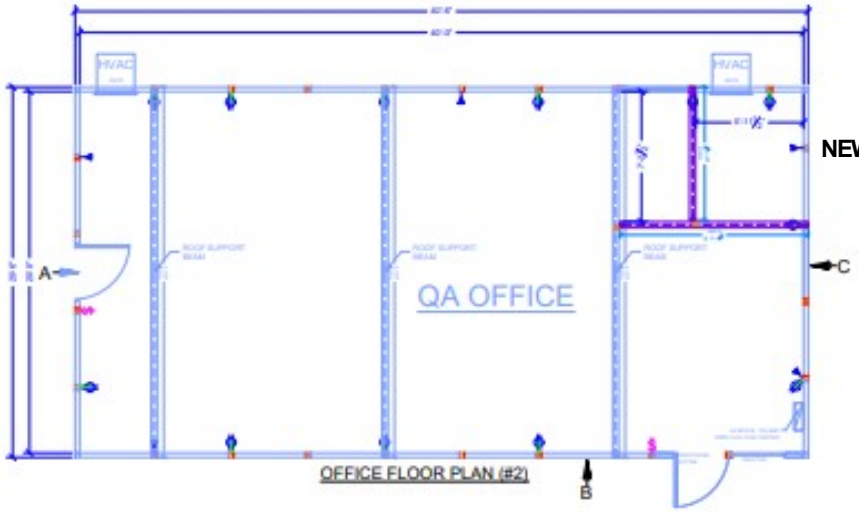
APPLICABLE BASIC LOAD COMBINATIONS
1. D + L
2. (1 + 0.105 Sds)D + 0.75L + 0.525ρQe)
3. (0.6 - 0 .14Sds)D + 0.7ρQe

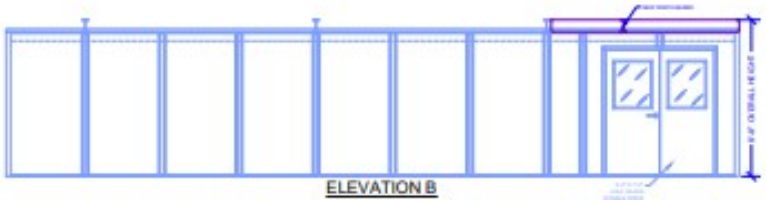
## DEFLECTION & DRIFT LIMITS

VERTICAL PER IBC TABLE 1604.3
HORIZONTAL SEISMIC PER ASCE TAB. 12.12-1

## MATERIAL SPECIFICATIONS

STEEL ROOF DECK: 22 GA. "B" 1-1/2" DEPTH, Fy = 38 KSI. PER ESR-2078P
ALUMINUM: ALLOY 6063 - T6, Fb = 25.0 KSI
WALLS: SANDWICH PANELS
CONCRETE: f'c = 2500 PSI
NYLON NAIL ANCHORS: POWERS 1/4" x 1/2"
EXP. ANCHORS: ITW RED HEAD WEDGE PER ESR-2427




# OFFICE #2

**ROOF DECK** **USE 1-1/2" x 22 GA. B-DECK**

$span := 6 \cdot ft$ $spacing := 12 \cdot in$ $Fy := 38 \cdot ksi$ $E := 29500 \cdot ksi$

PROPERTIES PER MANUFACTURER $Sx := 0.1757 \cdot in^3$ $Ix := 0.1485 \cdot in^4$

$M_a := \frac{Sx \cdot Fy}{1.67}$ $M_a = 333.16\,ft \cdot lb$ ALLOWABLE MOMENT FOR BENDING STRESS

FIND LOADS $w_g := (DL_r + LL_r) \cdot spacing$ $w_g = 29\,plf$ UNIF. GRAVITY LOAD

FIND REQUIRED MOMENT, STRESS RATIO AND DEFLECTION

$M_r := w_g \cdot \frac{span^2}{8}$ $M_r = 130.5\,ft \cdot lb$ $\frac{M_r}{M_a} = 0.39$ **OK < 1.0**

$\Delta := \frac{5 \cdot w_g \cdot span^4}{384 \cdot E \cdot Ix}$ $\Delta = 0.19\,in$ $\frac{span}{\Delta} = 372.99$ **OK > 120**

## MODULAR WALL PANELS IN BEARING

**USE 3" 3-PLY G/G PANELS**

COMPOSITE PANEL, GYP.BD. FACING BOTH SIDES, POLYSTYRENE CORE.

FIND THE ALLOWABLE BEARING FOR PANEL BASED ON RACKING LOAD TEST PERFORMED BY TWIN CITY TESTING CORP. USE THE AVG. FAILURE LOAD WITH A SAFETY FACTOR OF THREE. TEST PANEL LENGTH, 8 FT. HEIGHT 10 FT.

$SF := 3$ SAFETY FACTOR

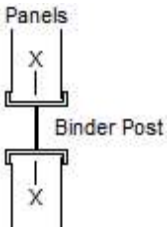
$F_{fail} := 3230 \cdot lb$ AVERAGE LATERAL LOAD PANELS FAILED, DEFLECTION = 2.2" JUST PRIOR TO FAILURE.

$P_{fail} := \frac{F_{fail} \cdot 10 \cdot ft}{8 \cdot ft}$ $P_{fail} = 4037.5\ lb$ RESULTANT AXIAL LOAD AT BINDER POST

$w_a := \frac{P_{fail}}{SF \cdot 4.25 \cdot ft}$ $w_a = 316.67\ plf$ ALLOWABLE UNIFORM LOAD/UNIT WIDTH

$w_g := (DL_r + LL_r) \cdot \frac{6 \cdot ft}{2}$ $w_g = 87\ plf$ UNIFORM LOAD $\frac{w_g}{w_a} = 0.27$ **OK < 1.0**

CHECK 5 PSF PARTITION LOAD BENDING MOMENT TO BINDER POST




$Sx := 0.529 \cdot in^3$ $F_y := 25.0 \cdot ksi$

$Mr := 5 \cdot psf \cdot 51 \cdot in \cdot \frac{(10 \cdot ft)^2}{8}$ $Mr = 265.63\ ft \cdot lb$ REQUIRED MOMENT

$Ma := \frac{Sx \cdot F_y}{1.67}$ $Ma = 659.93\ ft \cdot lb$ ALLOWABLE MOMENT

CHECK BINDER POST FOR BENDING $\frac{Mr}{Ma} = 0.4$ **OK < 1.0**

**ROOF SUPPORT BEAM, W 8 x 10** $span_b := 20.5 \cdot ft$ BEAM SPAN

PROPERTIES $S_x := 7.81 \cdot in^3$ $I_x := 30.8 \cdot in^4$ $F_y := 50 \cdot ksi$ $E = 29500\ ksi$

$M_a := \frac{S_x \cdot F_y}{1.67}$ $M_a = 19486.03\ ft \cdot lb$ ALLOWABLE MOMENT FOR BENDING STRESS

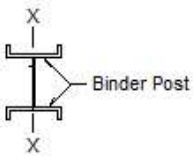
FIND LOADS $w_g := \left[ (DL_r) \cdot \frac{23.25 \cdot ft}{2} \right]$ $w_g = 104.63\ plf$ UNIFORM LOAD

FIND REQUIRED MOMENT, STRESS RATIO AND DEFLECTION

$M_r := \frac{w_g \cdot span_b^2}{8} + \frac{320 \cdot lb \cdot span_b}{4}$ $M_r = 7136.08\ ft \cdot lb$ $\frac{M_r}{M_a} = 0.37$ **OK < 1.0**

$\Delta := \frac{5 \cdot w_g \cdot span_b^4}{384 \cdot E \cdot I_x} + \frac{320 \cdot lb \cdot span_b^3}{48 \cdot E \cdot I_x}$ $\Delta = 0.57\ in$ $\frac{span_b}{\Delta} = 434.01$ **OK > 180**

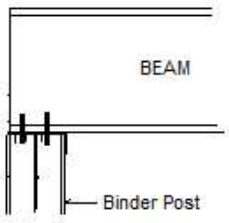
**USE BINDER POSTS AS SUPPORT COLUMNS**




$F_y := 25.0 \cdot ksi \quad E_a := 10000 \cdot ksi \quad Ht := 10 \cdot ft \quad Trib := 51 \cdot in$

PROPERTIES $Sx := 0.529 \cdot in^3 \quad Ix := 0.792 \cdot in^4 \quad A := 0.947 \cdot in^2 \quad r_x := 0.914 \cdot in$

$$F_e := \frac{\pi^2 \cdot E_a}{\left(\frac{1.0 \cdot Ht}{r_x}\right)^2} \qquad F_e = 5725.71\ psi \quad \text{LESS THAN} \qquad .44 \cdot F_y = 11000\ psi$$



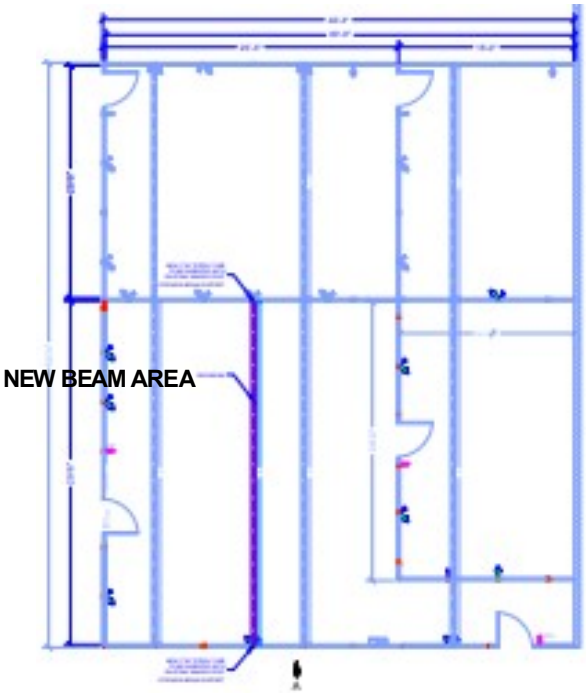

$F_{cr} := .877 \cdot F_e \quad F_{cr} = 5021.45\ psi$ CRITICAL BUCKLING STRESS

$P_n := 6199 \cdot psi \cdot 0.947 \cdot in^2 \quad P_n = 5870.45\ lb \quad P_a := \frac{P_n}{1.92} \quad P_a = 3057.53\ lb$ ALLOWABLE AXIAL LOAD

$$P_r := \frac{w_g \cdot span_b}{2} + \frac{320 \cdot lb}{2} \qquad P_r = 1232.41\ lb$$ REACTION

CHECK BINDER POST FOR AXIAL $\frac{P_r}{P_a} = 0.4$ **OK < 1.0**

**THE LATERAL RESISTANCE OF STRUCTURE IS UNAFFECTED**




## OFFICE #6

**ROOF DECK** **USE 1-1/2" x 22 GA. B-DECK**

$span := 8.5 \cdot ft$ $spacing := 12 \cdot in$ $Fy := 38 \cdot ksi$ $E := 29500 \cdot ksi$

PROPERTIES PER MANUFACTURER $Sx := 0.1757 \cdot in^3$ $Ix := 0.1485 \cdot in^4$

$M_a := \frac{Sx \cdot Fy}{1.67}$ $M_a = 333.16\,ft \cdot lb$ ALLOWABLE MOMENT FOR BENDING STRESS

FIND LOADS $w_g := (DL_r + LL_r) \cdot spacing$ $w_g = 29\,plf$ UNIF. GRAVITY LOAD

FIND REQUIRED MOMENT, STRESS RATIO AND DEFLECTION

$M_r := w_g \cdot \frac{span^2}{8}$ $M_r = 261.91\,ft \cdot lb$ $\frac{M_r}{M_a} = 0.79$ **OK < 1.0**

$\Delta := \frac{5 \cdot w_g \cdot span^4}{384 \cdot E \cdot Ix}$ $\Delta = 0.78\,in$ $\frac{span}{\Delta} = 131.19$ **OK > 120**

**MODULAR WALL PANELS IN BEARING**

**USE 3" 3-PLY G/G PANELS**

COMPOSITE PANEL, GYP.BD. FACING BOTH SIDES, POLYSTYRENE CORE.

FIND THE ALLOWABLE BEARING FOR PANEL BASED ON RACKING LOAD TEST PERFORMED BY TWIN CITY TESTING CORP. USE THE AVG. FAILURE LOAD WITH A SAFETY FACTOR OF THREE. TEST PANEL LENGTH, 8 FT. HEIGHT 10 FT.

$SF := 3$ SAFETY FACTOR

$F_{fail} := 3230 \cdot lb$ AVERAGE LATERAL LOAD PANELS FAILED, DEFLECTION = 2.2" JUST PRIOR TO FAILURE.

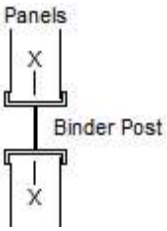
$P_{fail} := \frac{F_{fail} \cdot 10 \cdot ft}{8 \cdot ft}$ $P_{fail} = 4037.5\,lb$ RESULTANT AXIAL LOAD AT BINDER POST

$w_a := \frac{P_{fail}}{SF \cdot 4.25 \cdot ft}$ $w_a = 316.67\,plf$ ALLOWABLE UNIFORM LOAD/UNIT WIDTH

$w_g := (DL_r + LL_r) \cdot \frac{8.5 \cdot ft}{2}$ $w_g = 123.25\,plf$ UNIFORM LOAD $\frac{w_g}{w_a} = 0.39$ **OK < 1.0**

CHECK 5 PSF PARTITION LOAD BENDING MOMENT TO BINDER POST

$Sx := 0.529 \cdot in^3$ $F_y := 25.0 \cdot ksi$




$Mr := 5 \cdot psf \cdot 51 \cdot in \cdot \frac{(10 \cdot ft)^2}{8}$ $Mr = 265.63\,ft \cdot lb$ REQUIRED MOMENT

$Ma := \frac{Sx \cdot F_y}{1.67}$ $Ma = 659.93\,ft \cdot lb$ ALLOWABLE MOMENT

CHECK BINDER POST FOR BENDING $\frac{Mr}{Ma} = 0.4$ **OK < 1.0**

**ROOF SUPPORT BEAM, W 12 x 14** $span_b := 29.5 \cdot ft$ BEAM SPAN

PROPERTIES $S_x := 14.9 \cdot in^3$ $I_x := 88.6 \cdot in^4$ $F_y := 50 \cdot ksi$ $E = 29500\,ksi$

$M_a := \frac{S_x \cdot F_y}{1.67}$ $M_a = 37175.65\,ft \cdot lb$ ALLOWABLE MOMENT FOR BENDING STRESS

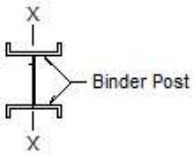
FIND LOADS $w_g := \left[ (DL_r + LL_r) \cdot \frac{12.75 \cdot ft}{2} \right]$ $w_g = 184.88\,plf$ UNIFORM LOAD

FIND REQUIRED MOMENT, STRESS RATIO AND DEFLECTION

$M_r := \frac{w_g \cdot span_b^2}{8}$ $M_r = 20110.93\,ft \cdot lb$ $\frac{M_r}{M_a} = 0.54$ **OK < 1.0**

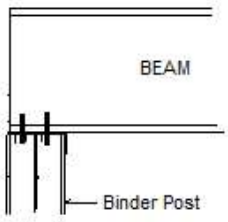
$\Delta := \frac{5 \cdot w_g \cdot span_b^4}{384 \cdot E \cdot I_x}$ $\Delta = 1.21\,in$ $\frac{span_b}{\Delta} = 293.7$ **OK > 180**

**USE BINDER POSTS AS SUPPORT COLUMNS**




$F_y := 25.0 \cdot ksi$ $E_a := 10000 \cdot ksi$ $Ht := 10 \cdot ft$ $Trib := 51 \cdot in$

PROPERTIES $Sx := 0.529 \cdot in^3$ $Ix := 0.792 \cdot in^4$ $A := 0.947 \cdot in^2$ $r_x := 0.914 \cdot in$




$F_e := \frac{\pi^2 \cdot E_a}{\left(\frac{1.0 \cdot Ht}{r_x}\right)^2}$ $F_e = 5725.71\,psi$ LESS THAN $.44 \cdot F_y = 11000\,psi$

$F_{cr} := .877 \cdot F_e$ $F_{cr} = 5021.45\,psi$ CRITICAL BUCKLING STRESS

$P_n := 6199 \cdot psi \cdot 0.947 \cdot in^2$ $P_n = 5870.45\,lb$ $P_a := \frac{P_n}{1.92}$ $P_a = 3057.53\,lb$ ALLOWABLE AXIAL LOAD

$P_r := \frac{w_g \cdot span_b}{2}$ $P_r = 2726.91\,lb$ REACTION CHECK BINDER POST FOR AXIAL $\frac{P_r}{P_a} = 0.89$ **OK < 1.0**

**THE LATERAL RESISTANCE OF STRUCTURE IS UNAFFECTED**

END DESIGN