Building Permit Application

CLACKAMAS COUNTY

150 Beavercreek Road, Oregon City, OR 97045
Phone: (503) 742-4240 Fax: (503) 742-4741
Inspection request: 503-742-4720
Internet address: www.clackamas.us

Date Recd:	Bldg #:
By:	Plmb #:
Simple/Complex:	Elec #:
Land Use Appr:	Prj #:

TYPE OF WORK	
☐ New construction	☐ Demolition
☐ Addition/alteration/replacement	☒ Other: Addition of Temporary Modular Classrooms
CATEGORY OF CONSTRUCTION	
☐ 1- and 2-family dwelling	☒ Commercial/industrial
☐ Accessory building	☐ Multi-family
☐ Master builder	☐ Other:
JOB SITE INFORMATION AND LOCATION	
Job site address: 14331 SE 132nd Ave	
City/State/ZIP: Clackamas, OR 97015	
Suite/bldg./apt. no.:	Project name: Temporary Modulars for Clackamas High School East
Cross street/directions to job site:	
Intersection of SE 132nd Avenue and SE Summers Lane	
Subdivision:	Lot no.:
Tax map/parcel no.: 22E02CD01200, 00423642	
DESCRIPTION OF WORK	
Addition of (2) modular buildings, each containing (2) classrooms. Scope includes associated decking, grading and irrigation modifications, site paving, utility routing and stormwater routing.	
☒ **PROPERTY OWNER**	☐ **TENANT**
Name: North Clackamas School District, Melinda Shumaker (rep)	
Address: 12449 SE Fuller Road	
City/State/ZIP: Milwaukie, OR 97222	
Phone: ( ) 503.353.6061	Fax: ( ) N/A
E-mail: shumakerm@nclack.k12.or.us	
☐ **APPLICANT**	☒ **CONTACT PERSON**
Business name: Bora Architects	
Contact name: Brian Squillace	
Address: 720 SW Washington Street, Suite 800	
City/State/ZIP: Portland, OR 97205	
Phone: ( ) 503.226.1575	Fax: ( ) N/A
E-mail: squillace@bora.co	
CONTRACTOR	
Business name: To be determined and provided prior to permit issuance	
Address: TBD	
City/State/ZIP: TBD	
Phone: ( ) TBD	Fax: ( )
E-mail: TBD	
CCB lic.: TBD	

Authorized signature: Melinda Shumaker

Print name: Melinda Shumaker	Date: 2/20/20

REQUIRED DATA: 1- AND 2-FAMILY DWELLING	
Permit fees* are based on the value of the work performed. Indicate the value (rounded to the nearest dollar) of all equipment, materials, labor, overhead, and the profit for the work indicated on this application.	
Valuation	
Number. of bedrooms:	
Number of bathrooms:	
Total number of floors:	
New dwelling area:	square feet
Garage/carport area:	square feet
Covered porch area:	square feet
Deck area:	square feet
Other structure area:	square feet

REQUIRED DATA: COMMERCIAL-USE CHECKLIST	
Permit fees* are based on the value of the work performed. Indicate the value (rounded to the nearest dollar) of all equipment, materials, labor, overhead, and the profit for the work indicated on this application.	
Valuation	$75,000
Existing building area:	106,528 square feet
New building area:	3,584 square feet
Number of stories:	1
Type of construction:	Pre-fabricated
Occupancy groups:	E, B, A-3
Existing:	E, B, A-3
New:	E

NOTICE

All contractors and subcontractors are required to be licensed with the Oregon Construction Contractors Board under ORS 701 and may be required to be licensed in the jurisdiction in which work is being performed. If the applicant is exempt from licensing, the following reasons apply:

BUILDING PERMIT FEES*	
Please refer to fee schedule	
Fees due upon application	
Amount received	
Date received:	

This permit application expires if a permit is not obtained within 180 days after it has been accepted as complete.

* Fee methodology set by Tri-County Building Industry Service Board
440-4613T (11/02/COM/WEB) CCP-PW12 (Rev. 3/15)

JOB# NW ACCESS ALUMINUM RAMPS	
SHEET NO 1	OF
CALCULATED BY MCL	DATE 2/12/2020
CHECKED BY	DATE
SCALE	

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

2018 IBC / ASCE7-16 / ADM-2015
STRUCTURAL CALCULATIONS FOR
ALUMINUM RAMPS & LANDINGS

KENNETH A. RASMUSSEN
STATE OF WASHINGTON
21548
REGISTERED PROFESSIONAL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
13431
OREGON
SEPT. 13, 1983
KENNETH A. RASMUSSEN

2/13/20
Exp 12/31/20

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB# NW ACCESS ALUMINUM RAMPS

SHEET NO MS-1	OF MS-2
CALCULATED BY MCL	DATE 3/8/2018
CHECKED BY	DATE
SCALE	

DESCRIPTION		MATERIAL DESCRIPTION	MATERIAL GRADE
HANDRAIL	USE	ALUMINUM PIPE: 1-1/4" NOMINAL O.D. x 0.140" WALL (SCHEDULE 40)	6063-T6
RAILING POST / GUARDRAILS	USE	ALUMINUM PIPE: 1-1/4" NOMINAL O.D. x 0.140" WALL (SCHEDULE 40)	6061-T6
RAILING POST FOOT	USE	ALUMINUM PIPE: 1" NOMINAL O.D. x 0.133" WALL (SCHEDULE 40)	6061-T6
RAILING POST BRACKET	USE	EXTRUSION PER DETAIL	6061-T6
CONNECTING BOLTS	USE	3/8 DIA. x AS REQ'D	303-A STAINLESS STEEL
RAMP DECK SUPPORT RAILS	USE	ALUMINUM EXTRUSION: 'C' CHANNEL 2" x 2" x 1/8" THK	6061-T6
RAMP DECK END PLATE	USE	ALUMINUM PLATE: 4" x 48" x 1/4" THK	6061-T6
LANDING DECK SUPPORT RAILS	USE	ALUMINUM EXTRUSION: 'C' CHANNEL 2" x 2" x 1/8" THK	6061-T6
RAMP EDGE EXTRUSION	USE	EXTRUSION PER DETAIL	6061-T6
LANDING EDGE EXTRUSION	USE	EXTRUSION PER DETAIL	6061-T6
STAIR STRINGER	USE	ALUMINUM PLATE: 8" x AS REQ'D x 1/4" THK	6061-T6

MODERN
BUILDING SYSTEMS

PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB# NW ACCESS ALUMINUM RAMPS

SHEET NO MS-2	OF MS-2
CALCULATED BY MCL	DATE 3/8/2018
CHECKED BY	DATE
SCALE	

HANDRAIL BRACKET EXTRUSION	USE	EXTRUSION PER DETAIL	6061-T6
CLAMP BRACKET EXTRUSION	USE	EXTRUSION PER DETAIL	6061-T6
FLAT PLATE AT ENTRY RAMP	USE	ALUMINUM PLATE: 24" x 48" x 1/4" THK	6061-T6
LOWER GUARD RAIL	USE	ALUMINUM DRAWN TUBE: 1" x 2" x .125" WALL	6061-T6
LATERAL DESIGN	USE	(2) 3/8" DIA. x 6" L, LAG SCREWS @ EA LANDING SECTIONS	
FOOTING PADS	USE	P.T. 2 x 12 x 12" HF #2 PADS @ SUPPORT LEGS	
DECKING	USE	SUN WALK DECKING PANELS	REF SHEETS

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

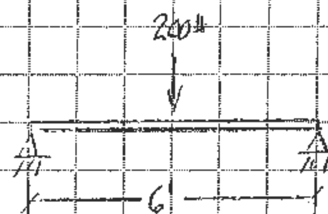
JOB ALUMINUM RAMPS
SHEET NO. R-1 OF R-32
CALCULATED BY MCL DATE 3-13-14
CHECKED BY ______ DATE ______
SCALE ______

HANDRAIL DESIGN PER IBC 2012/ASCE 7-10/ADM-2010

DESIGN LOADS @ TOP RAIL & HANDRAIL

50 plf OR 200# PT LOAD; IN ANY DIRECTION (ASCE 7-10, SEC 4.5.1)

$L_{MAX} = 6'$



$M_a = M_{MAX} = \frac{PL}{4} = \frac{200^{\#}(6')}{4}(12) = 3600$ lb-in

$M_a \leq M_n/\Omega$, TRY 6063-T6 ALUMINUM PIPE 1¼" Ø x 0.14" WALL

YIELDING & RUPTURE

COMPRESSIVE YIELDING: $M_n = 1.17(F_{cy})(S)$, $F_{cy} = 25$ ksi, $\Omega = 1.65$

(1¼" Ø) $I = \frac{\pi(d_o^4 - d_i^4)}{64} = \frac{\pi(1.66^4 - 1.38^4)}{64} = .195 \text{ in}^4$

$S = I/c = .195 \text{ in}^4 / .83 \text{ in} = .235 \text{ in}^3$

(ADM F.6.1) $\frac{M_n}{\Omega} = \frac{1.17(25000 \text{ psi})(.235 \text{ in}^3)}{1.65} = 4166$ lb-in ≥ 3600 lb-in

∴ OK FOR COMPRESSIVE YIELDING

(ADM F.6.1) TENSILE YIELDING: $M_n = 1.17(F_{ty})(S)$, $F_{ty} = 25$ ksi, $\Omega = 1.65$

$\frac{M_n}{\Omega}$ = (AS BEFORE) 4166 lb-in $\geq$ 3600 lb-in ∴ OK FOR TENSILE YIELDING

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

HANDRAIL DESIGN (CON'T)

(ADM F.6.1) TENSILE RUPTURE: $M_n = 1.24(F_{tu})(S)/k_t$, $F_{tu} = 30$ ksi, $\Omega = 1.95$
$k_t = 1.0$ (ADM-2010, TABLE A.3.3)

$$\frac{M_n}{\Omega} = \frac{1.24(30000\,psi)(.235\,in^3)}{(1.0)(1.95)} = 4483\ lb\text{-}in \geq 3600\ lb\text{-}in$$

∴ OK FOR TENSILE RUPTURE

(ADM F.6.2) LOCAL BUCKLING, $\Omega = 1.65$

(ADM-2010, TABLE 1-1)

SLENDERNESS LIMIT: $S_1 = \left(\frac{B_{tb} - B_t}{D_{tb} - D_t}\right)^2 = \left(\frac{45.7\,ksi - 30.5\,ksi}{4.458\,ksi - 0.978\,ksi}\right)^2 = 19.1$

$$R_b/t = \frac{(1.66 - 0.14)/2}{0.14''} = 5.43 \leq 19.1 = S_1 \therefore$$

$$F_b = B_{tb} - D_{tb}\sqrt{\frac{R_b}{t}} = 45700\,psi - 4458\,psi\sqrt{5.43} = 35312\,psi$$

$$\frac{M_n}{\Omega} = \frac{(F_b)(S)}{\Omega} = \frac{35312\,psi\,(.235\,in^3)}{1.65} = 5029\ lb\text{-}in \geq 3600\ lb\text{-}in$$

∴ OK FOR LOCAL BUCKLING

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

HANDRAIL DESIGN (CON'T)

SHEAR, $V_a \leq V_n / \Omega$, $\Omega = 1.65$

$V_a = 200^{\#}$

(ADM, G3-1) $V_n = F_s A_g / 2$

(ADM TABLE 1-1)

SLENDERNESS LIMIT: $S_1 = \dfrac{1.3B_s - F_{sy}}{1.63D_s} = \dfrac{1.3(19ksi) - (0.6)(25ksi)}{1.63(0.082ksi)} = 72.6$

(ADM, G3-2) $\lambda_t = 2.9\left(\dfrac{R_b}{t}\right)^{5/8}\left(\dfrac{L_v}{R_b}\right)^{1/4} = 2.9\left(\dfrac{.76}{.14}\right)^{5/8}\left(\dfrac{36}{.76}\right)^{1/4} = 21.9 \leq 72.6 = S_1 \therefore$

$F_s = F_{sy} = (0.6)(F_{ty}) = (0.6)(25ksi) = 15ksi$

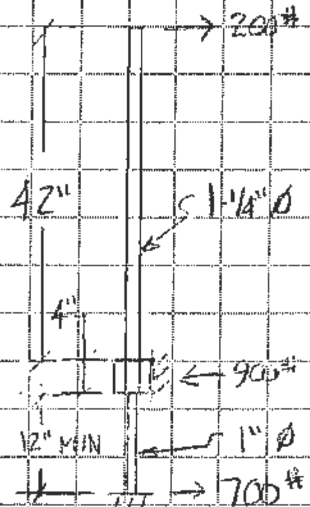
$\dfrac{V_n}{\Omega} = \dfrac{15000psi(.669in^2)}{2(1.65)} = 304^{\#} \geq 200^{\#} = V_a \therefore$ OK FOR SHEAR

$\boxed{\text{USE MIN 6063-T6 ALUMINUM PIPE 1-1/4" NOMINAL } \phi \text{ X 0.140 WALL}}$

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

JOB: ALUMINUM RAMPS
SHEET NO. R-4 OF R-32
CALCULATED BY: MCL DATE: 3-13-14
CHECKED BY: DATE:
SCALE:

RAILING POST (ASSUME WORST CASE FOR FOOT TUBE REACTION)



$M_{MAX} = PL = 200^{\#}(42") = 8400 \text{ lb-in}$

(1" ø) $I = \frac{\pi(d_1^4 - d_2^4)}{64} = \frac{\pi(1.315^4 - 1.049^4)}{64} = .0873 \text{ in}^4$

$S = I/c = .0873/.658 = .133 \text{ in}^3$

@ M_{MAX} $S_{TOT} = S_{1¼"} + S_{1"} = (.235 + .133) \text{ in}^3$

$S_{TOT} = .368 \text{ in}^3$

PROPORTION M_{MAX} TRY 6061-T6 ALUMINUM PIPE

(@ 1¼" ø) $M_{1¼} = 8400 \text{ lb-in} \left(\frac{.235 \text{ in}^3}{.368 \text{ in}^3}\right) = 5364 \text{ lb-in} = M_a$

YIELDING & RUPTURE (1¼" ø PIPE)

COMPRESSIVE YIELDING $F_{cy} = 35$ ksi, $\Omega = 1.65$

$\frac{M_n}{\Omega} = \frac{1.17(35000 \text{ psi})(.235 \text{ in}^3)}{1.65} = 5832 \text{ lb-in} \geq 5364 \text{ lb-in}$
∴ OK FOR COMPRESSIVE YIELDING

TENSILE YIELDING $F_{ty} = 35$ ksi, $\Omega = 1.6$

(AS BEFORE)
$\frac{M_n}{\Omega} = 5832 \text{ lb-in} \geq 5364 \text{ lb-in}$ ∴ OK FOR TENSILE YIELDING

TENSILE RUPTURE $F_{tu} = 38$ ksi, $\Omega = 1.95$

$\frac{M_n}{\Omega} = 1.24(F_{tu})(S)/k_t = \frac{1.24(38000 \text{ psi})(.235 \text{ in}^3)}{(1.0)(1.95)} = 5679 \text{ lb-in} \geq 5364 \text{ lb-in}$
∴ OK FOR TENSILE RUPTURE

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

JOB ALUMINUM RAMPS
SHEET NO. R-5 OF R-32
CALCULATED BY MCL DATE 3-13-14
CHECKED BY DATE
SCALE

RAILING POST (CON'T)

LOCAL BUCKLING, $\Omega = 1.65$

SLENDERNESS LIMIT $S_1 = \left(\frac{64.8\,ksi - 43.2\,ksi}{4.458\,ksi - 1.558\,ksi}\right)^2 = 55.5$

$Rb/t = \frac{(1.66 - 0.14)''/2}{0.14''} = 5.43 \leq 55.5 = S_1 \therefore$

$F_b = B_{tb} - D_{tb}\sqrt{\frac{Rb}{t}} = 64800\,psi - 4458\,psi\sqrt{5.43} = 54412\,psi$

$\frac{M_n}{\Omega} = \frac{(F_b)(S)}{\Omega} = \frac{54412\,psi\,(.235\,in^3)}{1.65} = 7750\,lb\text{-}in \geq 5364\,lb\text{-}in$
$\therefore$ OK FOR LOCAL BUCKLING

SHEAR (1-¼" ø PIPE)

$V_a = 900^{\#}$

SLENDERNESS LIMIT $S_1 = \frac{1.3(27.2\,ksi) - (0.6)(35.0\,ksi)}{1.63(0.141\,ksi)} = 62.5$

$\lambda_t = 2.9\left(\frac{.76}{.14}\right)^{5/8}\left(\frac{42}{.76}\right)^{1/4} = 22.8 \leq 62.5 = S_1 \therefore$

$F_s = F_{sy} = 0.6F_{ty} = 0.6(35\,ksi) = 21\,ksi$

$\frac{V_n}{\Omega} = \frac{21000\,psi\,(.669\,in^2)}{2(1.65)} = 4257^{\#} \geq 900^{\#} \therefore$ OK FOR SHEAR

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

RAILING POST (CONT'D) - 1" ø PIPE

PROPORTION MMAX TRY 6061-T6 ALUMINUM PIPE

(e 1" ø) $M_1 = 8400 \text{ lb-in} \left(\frac{.133 in^3}{.368 in^3}\right) = 3036 \text{ lb-in}$

YIELDING & RUPTURE (1" ø PIPE)

COMPRESSIVE YIELDING $F_{cy} = 35 \text{ ksi}$, $\Omega = 1.65$

$\frac{M_n}{\Omega} = \frac{1.17 (35000 psi)(.133 in^3)}{1.65} = 3301 \text{ lb-in} \geq 3036 \text{ lb-in}$

∴ OK FOR COMPRESSIVE YIELDING

TENSILE YIELDING $F_{ty} = 35 \text{ ksi}$, $\Omega = 1.65$

(AS BEFORE)

$\frac{M_n}{\Omega} = 3301 \text{ lb-in} \geq 3036 \text{ lb-in}$ ∴ OK FOR TENSILE YIELDING

TENSILE RUPTURE $F_{tu} = 38 \text{ ksi}$, $\Omega = 1.95$

$\frac{M_n}{\Omega} = \frac{1.24 (38000 psi)(.133 in^3)}{(1.0)(1.95)} = 3214 \text{ lb-in} \geq 3036 \text{ lb-in}$

∴ OK FOR TENSILE RUPTURE

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

RAILING POST (CON'T)

(1" Ø) LOCAL BUCKLING, $\Omega = 1.65$

$R_b/t = \frac{(1.315 - .133)/2}{.133} = 4.44 \le 7.44 = S_1$ ∴

$F_b = B_{tb} - D_{tb}\sqrt{\frac{R_b}{t}} = 64800\,psi - 4458\,psi\sqrt{4.44} = 55406\,psi$

$\frac{M_n}{\Omega} = \frac{(F_b)(S)}{\Omega} = \frac{55406\,psi(.133\,in^3)}{1.65} = 4466\ lb\text{-}in \ge 3036\ lb\text{-}in$
∴ OK FOR LOCAL BUCKLING

SHEAR (1" Ø PIPE) $\Omega = 1.65$

$V_a = 900^{\#}$

$\lambda_T = 2.9\left(\frac{.591}{.133}\right)^{5/8}\left(\frac{12}{.591}\right)^{1/4} = 15.6 \le 62.5 = S_1$ ∴

$F_s = F_{sy} = 0.6F_{ty} = 0.6(35\,ksi) = 21\,ksi$

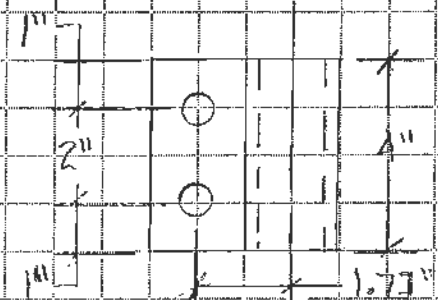
$\frac{V_n}{\Omega} = \frac{21000\,psi(.494\,in^2)}{2(1.65)} = 3144^{\#} \ge 900^{\#}$ ∴ OK FOR SHEAR

USE MIN 6061-T6 ALUMINUM PIPE 1-1/4" NOMINAL Ø x .140" WALL FOR RAILING POST AND 6061-T6 ALUMINUM PIPE 1" NOMINAL Ø x .133" WALL FOR RAILING POST FOOT

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

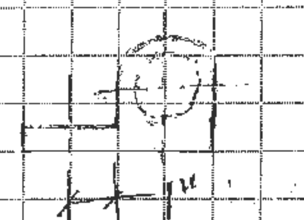
RAILING POST BRACKET (ASSUME WORST CASE FOR BRKT REACTION. REPLICATES FIELD USE.)

CHECK PLATE (.25" THICK)



FORCE IN BRKT @ BOTTOM EDGE $= \frac{(200^{\#})(58")}{12"} = 967^{\#}$

$M_{BRKT} = (967^{\#})(1") = 967$ lb-in



(PLATE) YIELDING & RUPTURE (ADM SEC F.4)

COMPRESSIVE YIELDING $\Omega = 1.65$, $F_{cy} = 35$ ksi,

$S = \frac{bd^2}{6} = \frac{(4")(.25")^2}{6} = .0417 in^3$

$\frac{M_n}{\Omega} = \frac{(1.3)(F_{cy})(S)}{\Omega} = \frac{1.3(35000 psi)(.0417 in^3)}{1.65} = 1150$ lb-in ≥ 967 lb-in

∴ OK FOR COMPRESSIVE YIELDING

TENSILE YIELDING, $\Omega = 1.65$, $F_{ty} = 35$ ksi

(AS BEFORE)
$\frac{M_n}{\Omega} = 1150$ lb-in ≥ 806 lb-in ∴ OK FOR TENSILE YIELDING

TENSILE RUPTURE, $\Omega = 1.95$, $F_{tu} = 38$ ksi (EXTRUSION), $k_t = 1.0$

$\frac{M_n}{\Omega} = \frac{1.42(F_{tu})(S)}{(k_t)\Omega} = \frac{1.42(38000 psi)(.0417 in^3)}{(1)1.95} = 1154$ lb-in ≥ 967 lb-in

∴ OK FOR TENSILE RUPTURE

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

JOB ALUMINUM RAMPS

CALCULATED BY MCL DATE 3-11-14
CHECKED BY ______ DATE ______
SCALE ______

RAILING POST BRACKET (CON'T)

(PLATE) LTB , $\Omega = 1.65$

SLENDERNESS LIMIT $S_2 = C_{br}/2.3 = 67/2.3 = 29.1$

$\frac{d}{t}\sqrt{\frac{L_b}{(C_b)(d)}} = \frac{4''}{.25''}\sqrt{\frac{3''}{(1)4''}} = 13.9 < 29.1 = S_2 \therefore$

$F_b = B_{br} - 2.3 D_{br}\left(\frac{d}{t}\sqrt{\frac{L_b}{(C_b)(d)}}\right) = 66.8\,ksi - 2.3(0.666)(13.9) = 45.5\,ksi$

$\frac{M_n}{\Omega} = \frac{(F_b)S}{\Omega} = \frac{45500\,psi\,(.0417\,in^3)}{1.65} = 1150\ lb\text{-}in \geq 967\ lb\text{-}in$
$\therefore$ OK FOR LTB

CHECK CIRCULAR PORTION AS ROUND TUBE (RAILING POST BRKT)

YIELDING + RUPTURE , $M_a = P\delta = 200^{\#}(42'') = 8400\ lb\text{-}in$

COMPRESSIVE YIELDING: $F_{cy} = 35\,ksi$, $\Omega = 1.65$

$I = \frac{\pi(2.08^4 - 1.70^4)}{64} = .509\,in^4$

$S = I/c = .509/1.04 = .489\,in^3$

$\frac{M_n}{\Omega} = \frac{1.17(35000\,psi)(.489\,in)}{1.65} = 12136\ lb\text{-}in \geq 8400\ lb\text{-}in$
$\therefore$ OK FOR COMPRESSIVE YIELDING

TENSILE YIELDING $F_{ty} = 35\,ksi$, $\Omega = 1.65$

(AS BEFORE)
$\frac{M_n}{\Omega} = 12136\ lb\text{-}in \geq 8400\ lb\text{-}in \therefore$ OK FOR TENSILE YIELDING

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

RAILING POST BRKT (CONT)

TENSILE RUPTURE, F_{tu} = 38 ksi (EXTRUSION), Ω = 1.95

$$\frac{M_n}{\Omega} = \frac{1.24(38000\,psi)(.489\,in^3)}{(1.7)(1.95)} = 11816 \text{ lb-in} \geq 8400 \text{ lb-in}$$

∴ OK FOR TENSILE RUPTURE

LOCAL BUCKLING Ω = 1.65

SLENDERNESS LIMIT $S_1 = \left(\frac{64.8-43.2}{4.458-1.358}\right)^2 = 55.5$

$$R_b/t = \frac{(2.08-.188)/2}{.188} = 5.03 \leq 55.5 = S_1 \therefore$$

$$F_b = B_{tb} - D_{tb}\sqrt{\frac{R_b}{t}} = 64.8\,ksi - 4.458\,ksi\sqrt{5.03} = 54.8\,ksi$$

$$\frac{M_n}{\Omega} = \frac{54.8\,ksi(.489\,in^3)}{1.65} = 16241 \text{ lb-in} \geq 8400 \text{ lb-in}$$

∴ OK FOR LOCAL BUCKLING

USE 6061-T6 RAILING POST BRKT EXTRUSION PER DETAIL

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

RAILING POST BOLTS @ BRKT

TRY (2) 3/8" ϕ, 303-A S.S.

TENSION $P_a = 2629\#$ (TENSION DUE TO HAND RAIL LOADING, SEE BELOW)

$\frac{P_n}{\Omega} = F_n A_b$, $\Omega = 2.0$, $A_b = \frac{\pi(.293\text{ in})^2}{4} = .0674\text{ in}^2$

$\frac{P_n}{\Omega} = \frac{75\text{ ksi}(.0674\text{ in}^2)}{2.0} = 2578\#$ WITHIN 2% OF 2629#

∴ OK FOR TENSION

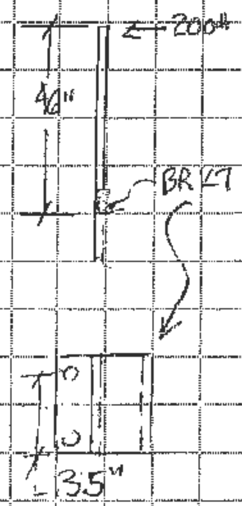
SHEAR

$P_a = (\overset{DL}{5} + \overset{LL}{100})\text{ psf}(2.5')(5')/2\text{ BOLTS} = 656\#$ (SHEAR FROM DECK LOADING)

$\frac{P_n}{\Omega} = \frac{30\text{ ksi}(.0674\text{ in}^2)}{2.0} = 1011\# \geq 656\#$ ∴ OK FOR SHEAR

USE MIN (2) 3/8" ϕ, 303-A S.S. BOLTS @ EA RAILING POST BRKT

(TENSION) $\frac{P_a}{\left(\frac{P_n}{\Omega}\right)} = \frac{225}{2578} = .09 < .20$ ∴ INTERACTION N/A



TENSION $M_{MAX} = PS = 46"(200\#) = 9200\text{ lb-in}$

@ UPPER BOLT

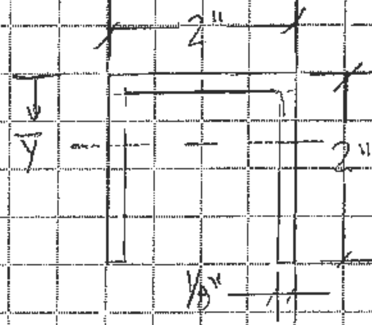
$T = C = \frac{M}{D} = \frac{9200\text{ lb-in}}{3.5\text{ in}} = 2629\#$

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

RAMP DESIGN

DECK SUPPORT RAILS

$L = 60"$, $S = 16"$ O.C.



$$\bar{y} = \frac{\bar{y}_1 A_1 + \bar{y}_2 A_2 + \ldots}{A_1 + A_2 + \ldots}$$

$$\bar{y} = \frac{(.125/2)"(.125")(2") + (2)(1.0625)"(.125)"(1.875)"}{(.125)"(2)" + (2)(.125)"(1.875)"} = .715"$$

$$I_x = I_{x'} + d^2_y A + \ldots$$

$$= \underbrace{\frac{(2")(0.125)^3}{12} + (.652")^2(2")(0.125")}_{.1066} + \underbrace{2\left[\frac{(.125)"(1.875)^3}{12} + (.3475)^2(.125")(1.875")\right]}_{.1939}$$

$I_x = .300\ in^4$

$S_t = I/c = \frac{.300\ in^4}{1.28\ in} = .234\ in^3$, $S_c = \frac{.300\ in^4}{.715\ in} = .420\ in^3$

$w = (\overset{DL}{5psf} + \overset{LL}{100psf})(1.33') = 140\ plf$ OR $5psf + 300^{\#}$ CONC LOAD

$M_1 = \frac{wL^2}{8} = \frac{140psf(5)^2}{8}(12) = 5250\ lb\text{-}in$ CONTROLS

$M_2 = \frac{wL^2}{8} + \frac{PL}{4} = \left[\frac{6.65plf(5)^2}{8} + \frac{300^{\#}(5)}{4}\right]12 = 4749\ lb\text{-}in$

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

JOB ALUMINUM RAMPS
SHEET NO. R-13 OF R-32
CALCULATED BY MCL DATE 3-14-14
CHECKED BY DATE
SCALE

DECK SUPPORT RAIL (CON'T)

YIELDING & RUPTURE (ADM 2010, SEC F.8)

COMPRESSIVE YIELDING $\Omega = 1.65$

$$\frac{M_n}{\Omega} = \frac{F_{cy} S_c}{} = \frac{35000 psi(.420 in^3)}{1.65} = 8909 \text{ lb-in} \geq 5250 \text{ lb-in}$$

$\therefore$ OK FOR COMPRESSIVE YIELDING

TENSILE YIELDING $\Omega = 1.65$

$$\frac{M_n}{\Omega} = \frac{1.3 F_{ty} S_t}{\Omega} = \frac{1.3(35000 psi)(.234 in^3)}{1.65} = 6453 \text{ lb-in} \geq 5250 \text{ lb-in}$$

$\therefore$ OK FOR TENSILE YIELDING

TENSILE RUPTURE, $\Omega = 1.95$

$$\frac{M}{\Omega} = \frac{1.42 F_{tu} S_t}{k_t \Omega} \quad \frac{1.42(38000)(.234 in^3)}{(1.0)\,1.95} = 6475 \text{ lb-in} \geq 5250 \text{ lb-in}$$

$\therefore$ OK FOR TENSILE RUPTURE

LOCAL BUCKLING $\Omega = 1.65$

(SLENDERNESS LIMIT) $$S_1 = \frac{B_{br} - 1.3 F_{cy}}{m D_{br}} = \frac{66.8 ksi - 1.3(35 ksi)}{1.3(1+1.79)(0.666)} = 8.82$$

$$b/t = \frac{(2 - .125)}{.125} = 15 \geq S_2$$

$$S_2 = \frac{k_1 B_{br}}{m D_{br}} = \frac{0.5(66.8 ksi)}{1.3(1+1.79)(0.666 ksi)} = 13$$

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

JOB ALUMINUM RAMPS
SHEET NO. R-14 OF R-32
CALCULATED BY MCL DATE ~~3-14-14~~
CHECKED BY DATE 4/6/15
SCALE

DECK SUPPORT RAILS (CONT)

$b/t \geq S_2 \therefore$

$$F_b = \frac{k_2 \sqrt{B_{br} E}}{(mb/t)} = \frac{2.04\sqrt{66.8\,ksi\,(10100\,ksi)}}{.13(161.79)\,15} = 30799\ psi$$

$$\frac{M_n}{\Omega} = \frac{F_b S_c}{\Omega} = \frac{30799\ psi\ (.420)}{1.65} = 7840\ lb\text{-}in \geq 5250\ lb\text{-}in$$

$\therefore$ OK FOR LOCAL BUCKLING

$$\Delta = \frac{wL^4}{384EI} = \frac{(140\,plf/12)\,60^4}{(384)(10100000)(.306)} = .13'' = L/460$$ (PARTIAL FIXITY ASSUMED)

$\therefore$ OK

$\boxed{\text{USE } 2''\times 2''\times 1/8''\ 6061\text{-}T6\ \text{ALUM 'C' CHANNEL}}$

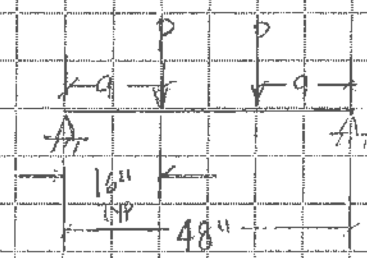
4/6/15 USE TS 2x2x0.13 BOX @ 12"o/c

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

JOB ALUMINUM RAMPS
SHEET NO. R-15 OF R-32
CALCULATED BY MCL DATE 3-14-14
CHECKED BY DATE
SCALE

RAMP DECK END PLATE - TR-1 3/16" x 4" x 48" 6061-T6 PLATE

$P = (5psf + 100psf)(2.5')(1.33') = 349^{\#}$



$M_a = (P)(a) = 349^{\#}(16") = 5584$ lb-in
4192

YIELDING & RUPTURE

$I = \frac{(3/16)(4")^3}{12} = 1 in^4$

$S = I/c = 1.0 in^4 / 2 in = 0.5 in^3$

COMPRESSIVE YIELDING, $\Omega = 1.65$, $F_{cy} = 35$ ksi

$\frac{M_n}{\Omega} = \frac{1.3(35000 psi)(0.5 in^3)}{1.65} = 13787$ lb-in ≥ 5584 lb-in $\therefore$ OK

TENSILE YIELDING, $\Omega = 1.65$, $F_{ty} = 35$ ksi

$\frac{M_n}{\Omega} = 13787$ lb-in ≥ 5584 lb-in $\therefore$ OK

TENSILE RUPTURE, $\Omega = 1.95$, $F_{tu} = 42$ ksi

$\frac{M_n}{\Omega} = \frac{1.42(42000)(0.5)}{1.95} = 15292$ lb-in ≥ 5584 lb-in $\therefore$ OK

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

DECK END PLATE - (CON'T)

L.T.B.

(SLENDERNESS LIMIT) $S_2 = C_{bn}/2.3 = 67ksi/2.3 = 29.1$

$L_b = 9"$ DUE TO BOLTED ATTACHMENT METHOD

$$\frac{d}{t}\sqrt{\frac{L_b}{C_b d}} = \frac{4.0}{.188}\sqrt{\frac{9}{1.0(4.0)}} = 31.9 > S_2 \therefore$$

$$F_b = \frac{\pi^2 E}{5.29\left(\frac{d}{t}\right)^2\left(\frac{L_b}{C_b d}\right)} = \frac{\pi^2 (10100000)}{5.29\left(\frac{4}{.188}\right)^2\left(\frac{9}{1.0(4.0)}\right)} = 18500\ psi$$

$$\frac{M_n}{\Omega} = \frac{F_b S}{\Omega} = \frac{18500 psi (0.5 in^3)}{1.65} = 5606\ lb\text{-}in \geq 5584\ lb\text{-}in \therefore \underline{\underline{OK}}$$

USE 6061-T6 PLATE, 3/16" x 4" x 48" PER DETAIL

UPGRADE TO 1/4" THK PLATE

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

LANDING DESIGN

LANDING SUPPORT RAILS

$L = 60"$, $S = 15"$ O.C. $w = (5+100)$ psf $(1.25') = 131$ plf

$M_1 = \frac{wL^2}{8} = \frac{131 \text{ plf}}{8}(5')^2(12) = \underline{4912 \text{ lb-in}}$ CONTROLS

$M_2 = \frac{wL^2}{8} + \frac{PL}{4} - \left[\frac{6.25 \text{ plf}(5')^2}{8} + \frac{300\#(5')}{4}\right](12) = 4734$ lb-in

(CONTROLS) TENSILE YIELDING = 6453 lb-in (AS BEFORE) $\geq$ 4912 lb-in ∴ OK (SEE R-13 & 14)

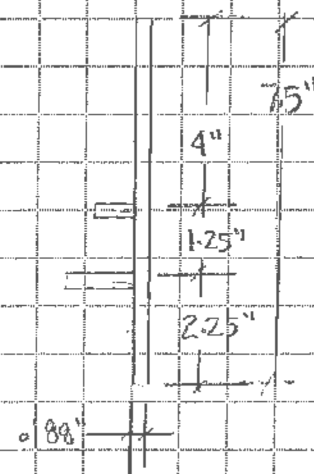
$\Delta = \frac{wL^4}{384EI} = \frac{(131 \text{ plf}/12)(60")^4}{384(10100000)(.300)} = .122" = L/492$ ∴ OK (PARTIAL FIXITY ASSUMED)

$\boxed{\text{USE } 2" \times 2" \times 1/8" \text{ 6061 T-6 ALUM 'C' CHANNEL}}$

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

JOB: ALUMINUM RAMPS
SHEET NO. R-18 OF R-32
CALCULATED BY: MG DATE: 3-18-14
CHECKED BY: DATE:
SCALE:

RAMP EDGE EXTRUSION - TRY 6061-T6



$$I = \frac{(.188")(7.5")^3}{12} = 6.6\,in^4$$

$$S = \frac{(.188)(7.5)^2}{6} = 1.76\,in^3$$

$$W = (5psf + 100psf)(.67') = 70plf$$

$$M_1 = \frac{(70plf)(5')^2}{8}(12) = 2625\ lb\text{-}in$$

$$M_2 = \frac{PL}{4} = \frac{300^{\#}(5')}{4}(12) = 4500\ lb\text{-}in$$ (CONTROLS)

YIELDING & RUPTURE

T&C YIELDING, $\Omega = 1.65$, $F_{cy} = F_{ty} = 35ksi$

$$\frac{M_n}{\Omega} = \frac{1.3(35000)(1.76)}{1.65} = 48533\ lb\text{-}in$$

TENSILE RUPTURE, $\Omega = 1.95$, $F_{tu} = 38ksi$

$$\frac{M_n}{\Omega} = \frac{1.42(38000)(1.76)}{1.95} = 48702\ lb\text{-}in$$

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

RAMP EDGE EXTRUSION (CONT)

L.T.B

(SLENDERNESS LIMIT) $S_2 = C_{br}/2.3 = 67/2.3 = 29.1$

$$\frac{d}{t}\sqrt{\frac{L_b}{C_b d}} = \frac{7.5}{.188}\sqrt{\frac{12}{1.0(7.5)}} = 50.5 > S_2 \therefore$$

$$F_b = \frac{\pi^2 E}{5.29\left(\frac{d}{t}\right)^2\left(\frac{L_b}{C_b d}\right)} = \frac{\pi^2(10100000)}{5.29\left(\frac{7.5}{.188}\right)^2\left(\frac{12}{1.0(7.5)}\right)} = 7400\ psi$$

$$\frac{M_n}{\Omega} = \frac{F_b S}{\Omega} = \frac{7400\,psi(1.76\,in^3)}{1.65} = 7893\ lb\text{-}in \geq 4500\ lb\text{-}in \therefore OK$$

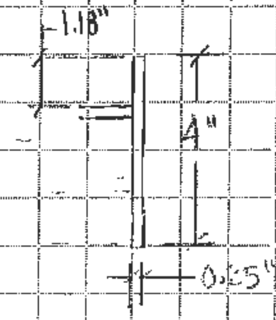
(CONTROLS)

USE 6061-T6 RAMP EDGE EXTRUSION PER DETAIL

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

LANDING EDGE EXTRUSION - TRY 6061-T6

$I = \frac{(.25")(4")^3}{12} = 1.33\ in^4$



$S = \frac{.25(4)^2}{6} = 0.67\ in^3$

$w = (5psf + 100psf)(2.5') = 262\ plf$ (WORST CASE)

$M_1 = \frac{262(5)^2}{8}(12) = 9825\ lb\text{-}in$ (CONTROLS) $M_2 = \frac{PL}{4} = \frac{300\#(5)}{4}(12) = 4500\ lb\text{-}in$

YIELDING + RUPTURE

T+C YIELDING, $\Omega = 1.65$, $F_{cy} = F_{ty} = 35\ ksi$

$\frac{M_n}{\Omega} = \frac{1.3(35000)(.67)}{1.65} = 18476\ lb\text{-}in$

TENSILE RUPTURE, $\Omega = 1.95$, $F_{tu} = 38\ ksi$

$\frac{M_n}{\Omega} = \frac{1.42(38000)(.67)}{1.95} = 18540\ lb\text{-}in$

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

LANDING EDGE EXTRUSION (CONT)

L.T.B

(SLENDERNESS LIMIT) $S_2 = C_{br}/2.3 = 67/2.3 = 29.1$

$\frac{d}{t}\sqrt{\frac{Lb}{Cb(d)}} = \frac{4}{.25}\sqrt{\frac{12}{1.0(4)}} = 27.7 < S_2$ ∴

$F_b = B_{br} - 2.3 D_{br}\left(\frac{d}{t}\right)\sqrt{\frac{Lb}{Cd(d)}} = 66.8\,ksi - 2.3(.664)\,27.7$

$= 24369\,psi$

$\frac{M_n}{\Omega} = \frac{F_b S}{\Omega} = \frac{24369(.67)}{1.65} = 9895$ lb-in ≥ 9825 lb-in ∴ OK
(CONTROLS)

USE 6061-T6 LANDING EDGE EXTRUSION PER DETAIL

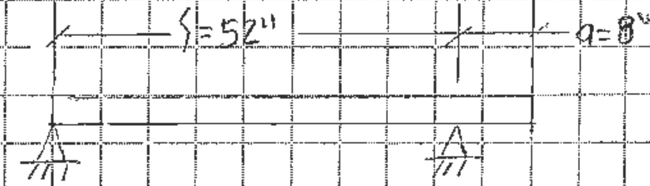
MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

JOB: ALUMINUM RAMPS
SHEET NO. R-22 OF R-32
CALCULATED BY: MLL DATE: 3-18-14
CHECKED BY: DATE:
SCALE:

LANDING END EXTRUSION - (SAME AS LANDING EDGE EXTRUSION)

$$w = (5\,psf + 100\,psf)(2.5') = 262\,plf$$

$$M = \frac{w}{8S^2}(S+a)^2(S-a)^2$$



$$= \frac{(262\,plf/12)(52+8)^2(52-8)^2}{8(52)^2}$$

$$= 7034\ lb\text{-}in \leq 9895\ lb\text{-}in \therefore \underline{OK}$$
(SEE R-21)

$\boxed{\text{USE 6061 T-6 LANDING EDGE EXTRUSION PER DETAIL}}$

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

STAIR DESIGN

STRINGER DESIGN - TRY 6061-T6 1/4" x 8"

$$w = (5psf + 100psf)(2.5') = 262plf$$

$$M_1 = \frac{262(5)^2}{8}(12) = 9825 \text{ lb-in (CONTROLS)}$$

$$M_2 = \frac{300\#(5')}{4}(12) = 4500 \text{ lb-in}$$

$$I = \frac{(.188)(8")^3}{12} = 8.02 \text{ in}^4$$

$$S = \frac{(.188")(8")^2}{6} = 2.01 \text{ in}^3$$

YIELDING & RUPTURE

T&C YIELDING, $\Omega = 1.65$, $F_{cy} = F_{ty} = 35$ ksi

$$\frac{M_n}{\Omega} = \frac{1.3(35000)(2.01)}{1.65} = 55427 \text{ lb-in}$$

TENSILE RUPTURE, $\Omega = 1.95$, $F_{tu} = 42$ ksi

$$\frac{M_n}{\Omega} = \frac{1.42(42000)(2.01)}{1.95} = 61475 \text{ lb-in}$$

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

STRINGER DESIGN (CON'T)

L.T.B., $\Omega = 1.65$

(SLENDERNESS LIMIT) $S_2 = C_{bn}/2.3 = 67/2.3 = 29.1$

$$\frac{d}{t}\sqrt{\frac{L_b}{C_b(d)}} = \frac{8}{.188}\sqrt{\frac{8}{1.0(8)}} = 42.6 > S_2 \therefore$$

$$F_b = \frac{\pi^2 E}{5.29\left(\frac{d}{t}\right)^2\left(\frac{L_b}{C_b(d)}\right)} = \frac{\pi^2(10100000)}{5.29\left(\frac{8}{.188}\right)^2\left(\frac{8}{1.0(8)}\right)} = 10406 \text{ psi}$$

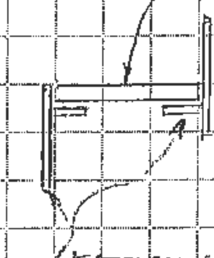
$$\frac{M_n}{\Omega} = \frac{F_b(S)}{\Omega} = \frac{10406\text{psi}(2.01\text{in}^3)}{1.65} = \underset{\text{(CONTROLS)}}{12676 \text{ lb-in}} \geq 9825 \text{ lb-in} \therefore \underline{OK}$$

$$\Delta = \frac{5wL^4}{384EI} = \frac{5(262/12)(60)^4}{384(10100000)(8.02)} = .045" = L/1333 \therefore \underline{OK}$$

$\boxed{\text{USE 6061-T6 PLATE } 3/16" \times 8"}$

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

STAIR EXTRUSIONS - (SAME AS LANDING EDGE EXTRUSIONS
(SEE R-20,21)



$w = (5psf + 100psf)(0.5') = 52plf$

$M_1 = \frac{52plf(5)^2}{8}(12) = 1950$ lb-in

$M_2 = \frac{300^{\#}\,5'}{4}(12) = \underline{4500}$ lb-in (CONTROLS)

4500 lb-in ≤ 9895 lb-in $\therefore$ OK

USE 6061-T6 LANDING EDGE EXTRUSIONS @ STAIRS

STAIR ATTACHMENT TO LANDING OR RAMP TO RAMP

$P = (5psf + 100psf)(4')(5/2) = 1050^{\#} \leq 3033^{\#} = (3\text{ BOLTS})\,1011^{\#}$ EA $\therefore$ OK
(SEE R-11)

USE MIN (3) 3/8"Ø, 304-A S.S. BOLTS

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

HAND RAIL BRKT. EXTRUSION

$M = Pa = 200^{\#}(2.143") = 429$ lb-in

$I = \frac{(2")(.313)^3}{12} = .0051$ in^4

$S = \frac{(2")(.313)^2}{6} = .033$ in^3

YIELDING + RUPTURE

T&C YIELDING, $\Omega = 1.65$, $F_{cy} = F_{ty} = 35$ ksi

$\frac{M_n}{\Omega} = \frac{1.3(35000)(.033)}{1.65} = 910$ lb-in ≥ 429 lb-in ∴ OK
(CONTROLS)

TENSILE RUPTURE, $\Omega = 1.95$, $F_{tu} = 38$ ksi

$\frac{M_n}{\Omega} = \frac{1.42(38000)(.033)}{1.95} = 913$ lb-in

L.T.B N/A BY INSPECTION

USE 6061 T-6 ALUM EXTRUSION PER DETAIL

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

CLAMP BRACKET EXTRUSION

$I = \frac{(2.0)(.25")^3}{12} = .0026 \text{ in}^4$

$S = \frac{(2.0)(.25)^2}{6} = .021 \text{ in}^3$

M = 429 lb-in (AS BEFORE, SEE R-26)

YIELDING & RUPTURE

T&C YIELDING, $\Omega = 1.65$, $F_{cy} = F_{ty} = 35$ ksi

$\frac{M_n}{\Omega} = \frac{1.3(35000)(.021)}{1.65} = 579$ lb-in $\geq$ 429 lb-in ∴ OK
(CONTROLS)

TENSILE RUPTURE, $\Omega = 1.95$, $F_{tu} = 38$ ksi

$\frac{M_n}{\Omega} = \frac{1.42(38000)(.021)}{1.95} = 581$ lb-in

LTB N/A BY INSPECTION

$\boxed{\text{USE 6061 T-6 ALUM EXTRUSION PER DETAIL}}$

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

FLAT PLATE AT ENTRY RAMP

$P = 300^{\#}$

$M = \frac{PL}{4} = \frac{300^{\#}(16")}{4} = 1200$ lb-in

$I = \frac{(12")(0.25")^3}{12} = .0156$ in^4

$S = \frac{12(.25)^2}{6} = .125$ in^3

YIELDING & RUPTURE

T&C YIELDING, $\Omega = 1.65$, $F_{cy} = F_{ty} = 35$ ksi

$\frac{M_n}{\Omega} = \frac{1.3(35000)(.125)}{1.65} = 3447$ lb-in ≥ 1200 lb-in $\therefore$ OK
(CONTROLS)

TENSILE RUPTURE, $\Omega = 1.95$, $F_{tu} = 42$ ksi

$\frac{M_n}{\Omega} = \frac{1.42(42000)(.125)}{1.95} = 3823$ lb-in

L.T.B, N/A BY INSPECTION

USE 6061-T6 ALUM PLATE, 1/4" x 4' x 2' @ TRANSITION TO FIRST RAMP

MODERN BUILDING SYSTEMS
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949 • Fax 503-749-4950

JOB ALUMINUM RAMPS
SHEET NO. R-29 OF R-32
CALCULATED BY MCL DATE 4-7-14
CHECKED BY DATE
SCALE

FILLET WELD STRENGTH (ADM SEC J.2.2)

$\frac{R_n}{\Omega} = (F_{sw})(L_{we})$, $\Omega = 1.95$, $L_{we} = 1in$

FILLER = 5554 ∴ $F_{tu} = 31ksi$, $F_{su} = 17ksi$ (ADM TABLE J.2.1)
WELDED ALUMINUM 6061 T-6 $F_{tuw} = 24ksi$, $F_{suw} = 15ksi$ (ADM TABLE A.3.5)

(CASE 1) WELD SIZE = S_w = .125", EFFECTIVE THROAT = .0884"

$F_{sw_A} = 17ksi\,(.0884") = 1503\,\#/"$ (CONTROLS)

$F_{sw_B} = 15ksi\,(.125") = 1875\,\#/"$

$F_{sw_C} = 24ksi\,(.125") = 3000\,\#/"$

$\frac{R_n}{\Omega} = \frac{1503\,\#/"\,(1")}{1.95} = \underline{\underline{771\#}}$ (PER INCH OF 1/8" FILLET WELD)

(CASE 2) WELD SIZE = S_w = .1875", EFFECTIVE THROAT = .131"

$F_{sw} = 17ksi\,(.131") = 2227\,\#/"$ (CONTROLS)

$\frac{R_n}{\Omega} = \frac{2227\,\#/"\,(1")}{1.95} = \underline{\underline{1142\#}}$ (PER INCH OF 3/16" FILLET WELD)

(CASE 3) WELD SIZE = .25", EFFECTIVE THROAT = .177"

$F_{sw} = 17ksi\,(.177") = 3009\,\#/"$ (CONTROLS)

$\frac{R_n}{\Omega} = \frac{3009\,\#/"\,(1")}{1.95} = \underline{\underline{1543\#}}$ (PER INCH OF 1/4" FILLET WELD)

MODERN BUILDING SYSTEMS
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949 • Fax 503-749-4950

LOWER RAIL DESIGN

DESIGN LOAD: 50# PT LOAD

$L_{MAX} = 6'$

$$M_a = \frac{PL}{4} = \frac{50^{\#}(6')}{4}(12) = 900 \text{ lb-in}$$

$M_a \geq M_n/\Omega$ TRY 1"x2" x .125" WALL, 6061 T-6 [illegible]

TENSION YIELDING, $F_{ty} = 35\text{ksi}$, $\Omega = 1.65$

$$\frac{M_n}{\Omega} = \frac{F_b(S)}{\Omega} = \frac{1.3F_{ty}(S_y)}{\Omega} = \frac{1.3(35\text{ksi})(.210)}{1.65} = 5791 \text{ lb-in} > 900 \text{ lb-in}$$

$\therefore$ OK

TENSILE RUPTURE, $F_{tu} = 42$ ksi, $\Omega = 1.95$

$$\frac{M_n}{\Omega} = \frac{F_b(S)}{\Omega} = \frac{(F_{tu}/k_t)(S)}{\Omega} = \frac{(42\text{ksi}/1.0)(.210)}{1.95} = 4523 \text{ lb-in} > 900 \text{ lb-in}$$

$\therefore$ OK

FLEXURAL COMPRESSION, $\Omega = 1.65$

$$S_1 = \frac{B_p - F_{cy}}{1.6D_p} = \frac{(45-35)\text{ksi}}{1.6(.30)} = 20.8$$

$$b/t = (2 - 2(.125))''/.125'' = 14 < 20.8 = S_1$$

$\therefore F_c = F_{cy} = 35\text{ksi}$

$$\frac{M_n}{\Omega} = \frac{F_c(S)}{\Omega} = \frac{35\text{ ksi}(.210\text{ in}^3)}{1.65} = 4455 \text{ lb-in} > 900 \text{ lb-in} \therefore \text{OK}$$

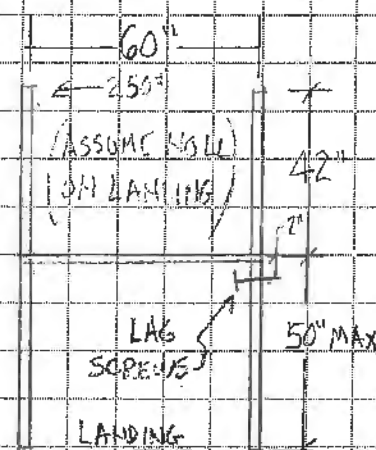
USE 6061 T-6 DRAWN TUBE 1"x2" x .125" WALL

MODERN BUILDING SYSTEMS
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949 • Fax 503-749-4950

LATERAL DESIGN

RISK CATEGORY = II, $I_e = 1.0$, $R = 2.0$, $S_S = 1.5$, $F_a = 1.0$, $R_c = 2.0$
$S_{DS} = 1.00$

$$V = \frac{S_{DS}}{\left(\frac{R}{I_e}\right)}(W)\overset{ASD}{(0.7)} = \frac{1.0}{\left(\frac{2.0}{1.0}\right)}W(.7) = .35W$$



LANDING WEIGHT

PIPE LEGS = (4)(12#) = 48#
PLATFORM = 5psf (5')(5') = 125#
RAILING = (2)(16#) = 32#

TOTAL 162# = W

$V = .35(W) = .35(162\#) = 57\# < 250\# = 50plf(5')$ ∴ LL CONTROLS

$M_{OT} = 250\#(42+50)/12 = 1917$ lb-ft

$M_R = 162\#(60/2)/12 = 405$ lb-ft

W/ FASTENERS = 2(240#)(60)/12 = 2400 lb-ft
(HDS TABLE 11K)

TOTALS = 405 lb-ft (0.6) + 2400 lb-ft = 2643 lb-ft > 1917 lb-ft ∴ OK

CHECK WITHDRAWAL

(RAMP OVERTURNING N/A DUE TO ATTACHMENT TO LANDING & GROUND)

$T = M/b = (250\#)(42+50)"/48" = 479\#$

$W = (2)(3")(235\#/") = 1410\# > 479\#$ ∴ OK

USE (2) 3/8" x 6" L. LAG SCREWS @ LANDING SECTION

MODERN BUILDING SYSTEMS
9493 Porter Road SE • PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949 • Fax 503-749-4950

FOOTING DESIGN

LANDING FOOTING → TRY 2x12 x12" HF #2 P.T. PAD

$P = (5\frac{1}{2})(5')(105\ psf) = 1312^{\#}$

$q = \dfrac{1312^{\#}}{\left(\frac{11.25"}{12"}\right)\left(\frac{12"}{12"}\right)} = 1399\ psf < 1500\ psf \therefore \underline{OK}$ ON SOIL

$M = \dfrac{wl^2}{2} = \dfrac{(1312^{\#}/12")(6")^2}{2} = 1968$ in-lb

$V = w$ [illegible] $= (1312/12)(4.5")\left(\frac{3}{2}\right) = 738^{\#}$

$F'b = 850\ psi\ (\overset{C_{fu}}{1.2})(\overset{C_M}{0.8}) = 816\ psi$

$fb = \dfrac{M}{S_{yy}} = 466\ psi < 816\ psi \therefore \underline{OK}$ FOR BENDING

$F'v = 95\ psi\ (\overset{C_M}{0.8}) = 76\ psi$

$fv = \dfrac{V}{A} = 44\ psi < 76\ psi \therefore \underline{OK}$ FOR SHEAR

RAMP FOOTING

$P = (4\frac{1}{2})(5')(105\ psf) = 1050^{\#} < 1312^{\#} \therefore$ LANDING CONTROLS

USE P.T. 2x12x12 HF#2 PADS @ SUPPORT LEGS

Table A.3.4
MECHANICAL PROPERTIES FOR WROUGHT ALUMINUM PRODUCTS (Continued)

ALLOY	TEMPER	PRODUCT	THICKNESS in.	F_{tu} ksi	F_{ty} ksi	F_{cy} ksi	F_{su} ksi	E ksi
5083	-O	Extrusions	up thru 5.000	39	16	16	24	10,400
	-H111	Extrusions	up thru 0.500	40	24	21	24	10,400
	-H111	Extrusions	0.501 to 5.000	40	24	21	23	10,400
	-O	Sheet & Plate	0.051 to 1.500	40	18	18	24	10,400
	-H116, H32, H321	Sheet & Plate	0.188 to 1.500	44	31	26	26	10,400
	-H116, H32, H321	Plate	1.501 to 3.000	41	29	24	24	10,400
5086	-O	Extrusions	up thru 5.000	35	14	14	21	10,400
	-H111	Extrusions	up thru 5.000	36	21	18	21	10,400
	-O	Sheet & Plate	0.020 to 2.000	35	14	14	21	10,400
	-H112	Plate	0.025 to 0.499	36	18	17	22	10,400
	-H112	Plate	0.500 to 1.000	35	16	16	21	10,400
	-H112	Plate	1.001 to 2.000	35	14	15	21	10,400
	-H112	Plate	2.001 to 3.000	34	14	15	21	10,400
	-H116	Sheet & Plate	All	40	28	26	24	10,400
	-H32	Sheet & Plate, Drawn Tube	All	40	28	26	24	10,400
	-H34	Sheet & Plate, Drawn Tube	All	44	34	32	26	10,400
5154	-H38	Sheet	0.006 to 0.128	45	35	33	24	10,300
5454	-O	Extrusions	up thru 5.000	31	12	12	19	10,400
	-H111	Extrusions	up thru 0.500	33	19	16	20	10,400
	-H111	Extrusions	0.501 to 5.000	33	19	16	19	10,400
	-H112	Extrusions	up thru 5.000	31	12	13	19	10,400
	-O	Sheet & Plate	0.020 to 3.000	31	12	12	19	10,400
	-H32	Sheet & Plate	0.020 to 2.000	36	26	24	21	10,400
	-H34	Sheet & Plate	0.020 to 1.000	39	29	27	23	10,400
5456	-O	Sheet & Plate	0.051 to 1.500	42	19	19	26	10,400
	-H116	Sheet & Plate	0.188 to 1.250	46	33	27	27	10,400
	-H32, H321	Sheet & Plate	0.188 to 0.499	46	33	27	27	10,400
	-H116	Plate	1.251 to 1.500	44	31	25	25	10,400
	-H32, H321	Plate	0.500 to 1.500	44	31	25	25	10,400
	-H116, H32, H321	Plate	1.501 to 3.000	41	29	25	25	10,400
6005	-T5	Extrusions	up thru 1.000	38	35	35	24	10,100
6005A	-T61	Extrusions	up thru 1.000	38	35	35	24	10,100
6061	-T6, T651	Sheet & Plate	0.010 to 4.000	42	35	35	27	10,100
	-T6, T6510, T6511	Extrusions	All	38	35	35	24	10,100
	-T6, T651	Rod & Bar	up thru 8.000	42	35	35	25	10,100
	-T6	Drawn Tube	0.025 to 0.500	42	35	35	27	10,100
	-T6	Pipe	All	38	35	35	24	10,100
6063	-T5	Extrusions	up thru 0.500	22	16	16	13	10,100
	-T5	Extrusions	0.501 to 1.000	21	15	15	12	10,100
	-T52	Extrusions	up thru 1.000	22	16	16	13	10,100
	-T6	Extrusions & Pipe	All	30	25	25	19	10,100
6066	-T6, T6510, T6511	Extrusions	All	50	45	45	27	10,100
6070	-T6, T62	Extrusions	up thru 2.999	48	45	45	29	10,100
6082	-T6, T6511	Extrusions	0.200 thru 6.000	45	38	38	25	10,100
6105	-T5	Extrusions	up thru 0.500	38	35	35	24	10,100
6351	-T5	Extrusions	up thru 1.000	38	35	35	24	10,100
6351	-T6	Extrusions	up thru 0.750	42	37	37	27	10,100
6463	-T6	Extrusions	up thru 0.500	30	25	25	19	10,100
7005	-T53	Extrusions	up thru 0.750	50	44	43	28	10,500

Note: Rod & Bar is rolled or cold finished.

Table A.3.5
MECHANICAL PROPERTIES FOR WELD-AFFECTED ZONES IN WROUGHT ALUMINUM PRODUCTS

ALLOY	TEMPER	PRODUCT	THICKNESS in.	F_{tuw} ksi	F_{tyw} ksi	F_{cyw} ksi	F_{suw} ksi	E ksi
1100	All	Sheet & Plate, Drawn Tube		11	3.5	3.5	8	10,100
1100	All	Rod & Bar		11	3.0	3.0	8	10,100
3003	All	Sheet & Plate, Drawn Tube		14	5	5	10	10,100
Alclad 3003	All	Sheet & Plate, Drawn Tube		13	4.5	4.5	10	10,100
3004	All	Sheet & Plate		22	8.5	8.5	14	10,100
3004	All	Drawn Tube		23	8.5	8.5	14	10,100
Alclad 3004	All	Sheet		21	8	8	13	10,100
3005	All	Sheet		17	6.5	6.5	12	10,100
5005	All	Sheet & Plate		15	5	5	9	10,100
5050	All	Sheet & Plate, Drawn Tube, Rod & Bar		18	6	6	12	10,100
5052	All	Sheet & Plate, Rod & Bar		25	9.5	9.5	16	10,200
5052	All	Drawn Tube		25	10	10	16	10,200
5083	All	Extrusions		39	16	16	24	10,400
5083	All	Sheet & Plate	0.188 to 1.500	40	18	18	24	10,400
5083	All	Plate	1.501 to 3.000	39	17	17	24	10,400
5086	All	Sheet & Plate, Extrusions, Drawn Tube		35	14	14	21	10,400
5154	All	Sheet		30	11	11	19	10,300
5454	All	Sheet & Plate, Extrusions		31	12	12	19	10,400
5456	All	Sheet & Plate	0.188–1.500	42	19	19	26	10,400
5456	All	Plate	1.501–3.000	41	18	17	25	10,400
6005	T5	Extrusions	up thru 1.000	24	13	13	15	10,100
6005A	T61	Extrusions	up thru 1.000	24	13	13	15	10,100
6061	T6, T651, T6510, T6511[1]	All		24	15	15	15	10,100
6061	T6, T651, T6510, T6511[2]	All	over 0.375	24	11	11	15	10,100
6063	T5, T52, T6	All		17	8	8	11	10,100
6082	T6, T6511	Extrusions	0.200 to 6.000	28	16	16	15	10,100
6105	T5	Extrusions	up thru 0.500	24	13	13	15	10,100
6351	T5, T6[1]	Extrusions		24	15	15	15	10,100
6351	T5, T6[2]	Extrusions	over 0.375	24	11	11	15	10,100
6463	T6	Extrusions	up thru 0.500	17	8	8	11	10,100
7005	T53	Extrusions	up thru 0.750	40	24	24	22	10,500

Notes
1. When welded with 5183, 5356, or 5556 alloy filler regardless of thickness, and when welded with 4043, 5554, or 5654 alloy filler for thicknesses ≤ 0.375 in..
2. When welded with 4043, 5554, or 5654 alloy filler.

Table J.2.1
FILLER STRENGTHS

Filler	Tensile Ultimate Strength (ksi)	Shear Ultimate Strength (ksi)
1100	11	7.5
2319	35	16
4043	24	11.5
4047	–	13
4643	–	13.5
5183	40	21
5356	35	17
5554	31	17
5556	42	20
5654	30	12

Table J.2.1M
FILLER STRENGTHS

Filler	Tensile Ultimate Strength (MPa)	Shear Ultimate Strength (MPa)
1100	75	50
2319	240	110
4043	165	80
4047	–	90
4643	–	95
5183	275	145
5356	240	115
5554	215	115
5556	290	140
5654	205	85

J.2.4 Stud Welds

The nominal tensile strength R_n of a stud weld is:

$$R_n = T_{uw} \tag{J.2-5}$$

where

T_{uw} = tensile strength of the stud in Table J.2.2 or Table J.2.2M

The base metal thickness for arc stud welding shall not be less than 50% of the stud diameter. The base metal thickness for capacitor discharge stud welding shall not be less than 25% of the stud diameter.

J.2.5 Post-Weld Heat Treating

For 6005 lighting poles through 0.250 in. (6 mm) thick welded in the T1 temper with 4043 filler and artificially aged to the T5 temper after welding, design and allowable

Table J.2.2
TENSILE STRENGTHS FOR 5183, 5356, AND 5556 STUDS

Stud Size	Arc (lb)	Capacitor Discharge (lb)
6–32	–	375
8–32	–	635
10–24	770	770
¼–20	1360	1360
5/16–18	2300	2300
⅜–16	3250	–
7/16–14	4400	–
½–13	5950	–

Table J.2.2M
TENSILE STRENGTHS FOR 5183, 5356, AND 5556 STUDS

Stud Size	Arc (kN)	Capacitor Discharge (kN)
6–32	–	1.67
8–32	–	2.82
10–24	3.42	3.42
¼–20	6.05	6.05
5/16–18	10.2	10.2
⅜–16	14.5	–
7/16–14	19.6	–
½–13	26.5	–

stresses of the base metal within 1.0 in. (25 mm) of the weld shall be 85% of the values for unwelded 6005-T5.

For 6063 lighting poles through 0.375 in. (10 mm) thick welded in the T4 temper with 4043 filler and artificially aged to the T6 temper after welding:

a) The design and allowable stresses of the base metal within 1.0 in. (25 mm) of the weld shall be 85% of the values for unwelded 6063-T6.
b) The design stress is 12.5 ksi (85 MPa) and the allowable stress is 8 ksi (55 MPa) for welds in socket type bases.
c) The design stress is 9 ksi (60 MPa) and the allowable stress is 5.9 ksi (41 MPa) for welds in other than socket type bases.

J.3 Bolts

J.3.1 Bolt Material

Bolt material shall be:

a) Aluminum: Bolts shall meet ASTM F 468 and be 2024-T4, 6061-T6, or 7075-T73. When 2024 bolts will be exposed to contact with liquid water or humidity near

Table 1-1
BUCKLING CONSTANTS (UNWELDED) (Continued)

Alloy	Temper	Product*	Thickness in.	B_c ksi	D_c ksi	C_c	B_p ksi	D_p ksi	C_p	B_t ksi	D_t ksi	C_t	B_{br} ksi	D_{br} ksi	C_{br}	B_{tb} ksi	D_{tb} ksi	C_{tb}	B_s ksi	D_s ksi	C_s
5454	O	Extrusions	up thru 5.000	13.3	0.058	152	15.6	0.074	140	15.4	0.475	495	20.7	0.113	122	23.1	1.117	144	9.4	0.035	181
	H111	Extrusions	up thru 0.500	18.0	0.092	131	21.3	0.118	120	20.8	0.709	376	28.3	0.181	104	31.2	1.668	118	15.5	0.073	141
	H111	Extrusions	0.501 to 5.000	18.0	0.092	131	21.3	0.118	120	20.8	0.709	376	28.3	0.181	104	31.2	1.668	118	15.5	0.073	141
	H112	Extrusions	up thru 5.000	14.5	0.068	146	17.0	0.084	135	16.8	0.531	458	22.6	0.129	117	25.1	1.249	136	9.4	0.035	181
	O	Sheet & Plate	0.020 to 3.000	13.3	0.058	152	15.6	0.074	140	15.4	0.475	495	20.7	0.113	122	23.1	1.117	144	9.4	0.035	181
	H32	Sheet & Plate	0.020 to 2.000	27.7	0.175	105	33.1	0.229	96	31.8	1.249	254	44.1	0.352	84	47.7	2.939	89	21.9	0.123	119
	H34	Sheet & Plate	0.020 to 1.000	31.4	0.212	99	37.6	0.277	90	36.0	1.473	227	50.2	0.427	78	54.0	3.465	82	24.7	0.147	112
5456	O	Sheet & Plate	0.051 to 1.500	21.6	0.121	119	25.7	0.156	110	24.9	0.901	499	34.1	0.240	95	37.4	2.120	104	15.5	0.073	141
	H116	Sheet & Plate	0.188 to 1.250	31.4	0.212	99	37.6	0.277	90	36.0	1.473	227	50.2	0.427	78	54.0	3.465	82	28.4	0.182	104
	H32, H321	Sheet & Plate	0.188 to 0.499	31.4	0.212	99	37.6	0.277	90	36.0	1.473	227	50.2	0.427	78	54.0	3.465	82	28.4	0.182	104
	H116	Plate	1.251 to 1.500	29.0	0.187	103	34.6	0.245	94	33.2	1.322	244	46.1	0.376	82	49.8	3.112	86	26.5	0.164	108
	H32, H321	Plate	0.501 to 1.500	29.0	0.187	103	34.6	0.245	94	33.2	1.322	244	46.1	0.376	82	49.8	3.112	86	26.5	0.164	108
	H116, H32, H321	Plate	1.501 to 3.000	29.0	0.187	103	34.6	0.245	94	33.2	1.322	244	46.1	0.376	82	49.8	3.112	86	24.7	0.147	112
6005	T5	Extrusions	up thru 1.000	39.4	0.246	66	45.0	0.300	61	43.2	1.558	141	66.8	0.666	67	64.8	4.458	55	27.2	0.141	79
6005A	T61	Extrusions	up thru 1.000	39.4	0.246	66	45.0	0.300	61	43.2	1.558	141	66.8	0.666	67	64.8	4.458	55	27.2	0.141	79
6061	T6, T651	Sheet & Plate	0.010 to 4.000	39.4	0.246	66	45.0	0.300	61	43.2	1.558	141	66.8	0.666	67	64.8	4.458	55	27.2	0.141	79
	T6, T6510, T6511	Extrusions	All	39.4	0.246	66	45.0	0.300	61	43.2	1.558	141	66.8	0.666	67	64.8	4.458	55	27.2	0.141	79
	T6, T651	Rod & Bar	up thru 8.000	39.4	0.246	66	45.0	0.300	61	43.2	1.558	141	66.8	0.666	67	64.8	4.458	55	27.2	0.141	79
	T6	Drawn Tube	0.025 to 0.500	39.4	0.246	66	45.0	0.300	61	43.2	1.558	141	66.8	0.666	67	64.8	4.458	55	27.2	0.141	79
	T6	Pipe	All	39.4	0.246	66	45.0	0.300	61	43.2	1.558	141	66.8	0.666	67	64.8	4.458	55	27.2	0.141	79
6063	T5	Extrusions	up thru 0.500	17.3	0.072	99	19.5	0.086	93	19.2	0.529	275	28.3	0.184	103	28.8	1.513	95	11.8	0.040	120
	T5	Extrusions	0.500 to 1.000	16.2	0.065	102	18.2	0.077	97	18.0	0.484	290	26.4	0.165	106	26.9	1.384	100	11.0	0.036	124
	T52	Extrusions	up thru 1.000	17.3	0.072	99	19.5	0.086	93	19.2	0.529	275	28.3	0.184	103	28.8	1.513	95	11.8	0.040	120
	T6	Extrusions & Pipe	All	27.6	0.145	78	31.4	0.175	74	30.5	0.978	189	46.1	0.382	81	45.7	2.800	70	19.0	0.082	95
6066	T6, T6510, T6511	Extrusions	All	51.4	0.366	57	59.0	0.451	54	56.1	2.206	112	88.3	1.011	58	84.1	6.313	47	35.7	0.212	69
6070	T6, T62	Extrusions	up thru 2.999	51.4	0.366	57	59.0	0.451	54	56.1	2.206	112	88.3	1.011	58	84.1	6.313	47	35.7	0.212	69
6082	T6, T6511	Extrusions	0.200 thru 6.000	42.9	0.280	63	49.2	0.343	59	47.0	1.745	131	73.2	0.763	64	70.6	4.995	52	29.8	0.162	76
6105	T5	Extrusions	up thru 0.500	39.4	0.246	66	45.0	0.300	61	43.2	1.558	141	66.8	0.666	67	64.8	4.458	55	27.2	0.141	79
6351	T5	Extrusions	up thru 1.000	39.4	0.246	66	45.0	0.300	61	43.2	1.558	141	66.8	0.666	67	64.8	4.458	55	27.2	0.141	79
6351	T6	Extrusions	up thru 0.750	41.7	0.268	64	47.8	0.329	60	45.8	1.682	134	71.1	0.730	65	68.6	4.814	53	28.9	0.155	77
6463	T6	Extrusions	up thru 0.500	27.6	0.145	78	31.4	0.175	74	30.5	0.978	189	46.1	0.382	81	45.7	2.800	70	19.0	0.082	95
7005	T53	Extrusions	up thru 0.750	48.9	0.334	60	56.2	0.411	56	53.5	2.045	121	84.0	0.920	61	80.2	5.852	49	34.9	0.201	71

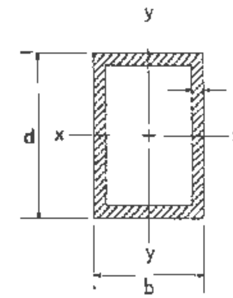
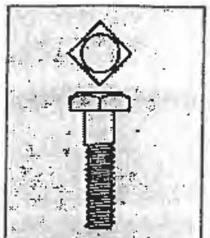
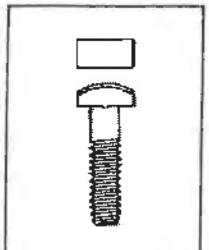


Table 24
RECTANGULAR TUBES

Designation	Width b in.	Depth d in.	Thickness t in.	Weight lb/ft	Area A in²	Axis x-x I_x in⁴	Axis x-x S_x in³	Axis x-x r_x in.	Axis y-y I_y in⁴	Axis y-y S_y in³	Axis y-y r_y in.	J in⁴
RT 1 x 1 1/2 x 1/8	1.000	1.500	0.125	0.662	0.563	0.159	0.212	0.532	0.0811	0.162	0.380	0.161
RT 1 x 2 x 1/8	1.000	2.000	0.125	0.809	0.688	0.332	0.332	0.695	0.105	0.210	0.391	0.245
RT 1 x 2 1/2 x 1/8	1.000	2.500	0.125	0.956	0.813	0.590	0.472	0.852	0.129	0.258	0.399	0.332
RT 1 x 3 x 1/8	1.000	3.000	0.125	1.10	0.938	0.950	0.633	1.01	0.153	0.307	0.404	0.422
RT 1 x 4 x 1/8	1.000	4.000	0.125	1.40	1.19	2.04	1.02	1.31	0.201	0.403	0.412	0.605
RT 1 1/4 x 2 x 1/8	1.250	2.000	0.125	0.882	0.750	0.387	0.387	0.718	0.180	0.288	0.489	0.371
RT 1 1/4 x 2 1/2 x 1/8	1.250	2.500	0.125	1.03	0.875	0.678	0.543	0.881	0.219	0.351	0.501	0.510
RT 1 1/4 x 3 x 1/8	1.250	3.000	0.125	1.18	1.00	1.08	0.720	1.04	0.259	0.415	0.509	0.654
RT 1 1/2 x 1 3/4 x 1/8	1.500	1.750	0.125	0.882	0.750	0.318	0.364	0.652	0.248	0.331	0.575	0.416
RT 1 1/2 x 2 x 1/8	1.500	2.000	0.125	0.956	0.813	0.442	0.442	0.737	0.278	0.370	0.585	0.511
RT 1 1/2 x 2 x 1/4	1.500	2.000	0.250	1.76	1.50	0.719	0.719	0.692	0.438	0.583	0.540	0.798
RT 1 1/2 x 2 1/2 x 1/8	1.500	2.500	0.125	1.10	0.938	0.767	0.613	0.904	0.337	0.449	0.599	0.711
RT 1 1/2 x 3 x 1/8	1.500	3.000	0.125	1.25	1.06	1.21	0.806	1.07	0.396	0.528	0.611	0.919
RT 1 1/2 x 3 x 3/16	1.500	3.000	0.188	1.82	1.55	1.68	1.12	1.04	0.533	0.711	0.586	1.24
RT 1 1/2 x 4 x 1/8	1.500	4.000	0.125	1.54	1.31	2.51	1.25	1.38	0.515	0.686	0.626	1.35
RT 1 1/2 x 6 x 1/8	1.500	6.000	0.125	2.13	1.81	7.20	2.40	1.99	0.752	1.00	0.644	2.25
RT 1 3/4 x 2 x 1/8	1.750	2.000	0.125	1.03	0.875	0.497	0.497	0.753	0.401	0.458	0.677	0.663
RT 1 3/4 x 2 1/4 x 1/8	1.750	2.250	0.125	1.10	0.938	0.661	0.588	0.840	0.442	0.506	0.687	0.795
RT 1 3/4 x 2 1/2 x 1/8	1.750	2.500	0.125	1.18	1.00	0.855	0.684	0.925	0.484	0.553	0.696	0.931
RT 1 3/4 x 2 3/4 x 1/8	1.750	2.750	0.125	1.25	1.06	1.08	0.785	1.01	0.525	0.600	0.703	1.07
RT 1 3/4 x 3 x 1/8	1.750	3.000	0.125	1.32	1.13	1.34	0.892	1.09	0.566	0.647	0.710	1.21
RT 1 3/4 x 3 1/2 x 1/8	1.750	3.500	0.125	1.47	1.25	1.96	1.12	1.25	0.649	0.742	0.721	1.50
RT 1 3/4 x 4 x 1/8	1.750	4.000	0.125	1.62	1.38	2.74	1.37	1.41	0.732	0.836	0.730	1.80
RT 1 3/4 x 4 1/2 x 1/8	1.750	4.500	0.125	1.76	1.50	3.69	1.64	1.57	0.814	0.931	0.737	2.11
RT 1 3/4 x 5 x 1/8	1.750	5.000	0.125	1.91	1.63	4.83	1.93	1.72	0.897	1.03	0.743	2.41
RT 1 3/4 x 5 x 3/16	1.750	5.000	0.188	2.82	2.40	6.91	2.76	1.70	1.23	1.41	0.717	3.33
RT 1 3/4 x 6 x 1/8	1.750	6.000	0.125	2.21	1.88	7.74	2.58	2.03	1.06	1.21	0.753	3.04



SQUARE HEAD BOLT



T BOLT

MACHINABILITY

The addition of sulfur and selenium to the austenitic grades of material improves the machinability of these alloys. These elements, in combination with the chromium and manganese in these alloys, form stringer like inclusions in the structure, which allow better chip removal.

For instance, Type 303 has a considerably higher sulfur content that enhances machining characteristics. This property might be very beneficial in the production of large bolts or where small production runs or specials are needed.

However, it should be recognized that while the 18-8 stainless steels are considered to have similar corrosion resistance to one another, the sulfide stringers in Type 303 can result in end grain attack at cut ends, especially when exposed to water or some chemical solutions. Accordingly, a designer should specify Type 304 when it is known that Type 303 is not suitable for the application. When in

Table 3 **MECHANICAL REQUIREMENTS FOR STAINLESS STEEL BOLTS, SCREWS, STUDS AND NUTS (ASTM F593-91)**

GRADE[1]	GENERAL DESCRIPTION	MECHANICAL REQUIREMENTS — BOLTS, SCREWS AND STUDS — FULL SIZE BOLTS, SCREWS, STUDS: YIELD[2] STRENGTH min ksi	TENSILE STRENGTH min ksi	MACHINED TEST SPECIMENS OF BOLTS, SCREWS, STUDS: YIELD[2] STRENGTH min ksi	TENSILE STRENGTH min ksi	ELONGATION[3] % Min	HARDNESS ROCKWELL Min	NUTS: PROOF LOAD STRESS ksi	HARDNESS ROCKWELL Min
303-A 304-A	Austenitic Stainless Steel-Sol. Annealed	30	75	30	75	20	B75	75	B75
304 305 316 384 XM7*	Austenitic Stainless Steel-Cold Worked	50	90	45	85	20	B85	90	B85
305-A 316-A 384-A XM7-A*	Austenitic Stainless Steel-Sol. Annealed	30	75	30	75	20	B70	75	B70
304-SH 305-SH 316-SH	Austenitic Stainless Steel-Strain Hardened	See Note 6	See Note 6	See Note 6	See Note 6	15	C25	See Note 6	C20
410-H 416-H	Martensitic Stainless Steel-Hardened and Tempered	95	125	95	125	20	C22	125	C22
410-HT 416-HT	Martensitic Stainless Steel-Hardened and Tempered	135	180	135	180	12	C36	180	C36
430	Ferritic Stainless Steel-	40	70	40	70	20	B75	70	B75

* Type 30430

KEYS TO TABLE 3

1. Legend of grade designations: —
   A—solution annealed
   SH—strain hardened
   H—hardened and tempered at 1100 F min.
   HT—hardened and tempered at 525 F± 50 F
2. Yield strength is the stress at which an offset of 0.2% of gauge length occurs for all stainless steels.
3. Elongation is determined using a gauge length of 2 in. or 4 diameters of test specimen in accordance with Federal Standard 151, Method 211.

NOTES

4. Loads at minimum yield strength and minimum ultimate tensile strength for full size products may be computed by multiplying the yield strength and tensile strength stresses as given in Table 3 by the stress area for the product size and thread series as given in Table 5.
5. Proof loads of nuts (in pounds) may be computed by multiplying the proof load stress as given in Table 3 by the stress area for the nut size and thread series given in Table 5.
6. Ausenitic stainless steel, strain hardened bolts, screws, studs and nuts shall have the following strength properties:

PRODUCT SIZE in.	BOLTS, SCREWS, STUDS — TESTED FULL SIZE: YIELD STRENGTH min ksi	TENSILE STRENGTH min ksi	MACHINED TEST SPECIMENS: YIELD STRENGTH min ksi	TENSILE STRENGTH min ksi	NUTS: PROOF LOAD STRESS ksi
to ⅝ in.	100	125	90	115	125
over ⅝ to 1 in.	70	105	65	100	105
over 1 to 1½ in.	50	90	45	85	90

45553 DIE NUMBER | A-52842 DRAWING NUMBER

sapa:

7933 NE 21st Ave
Portland, OR 97211-0263
(800) 547-0790

A

CUSTOMER NAME	MAG ENTERPRISES LLC
PART NAME	LEG POCKET
PART NO	
DATE	5-11-2012

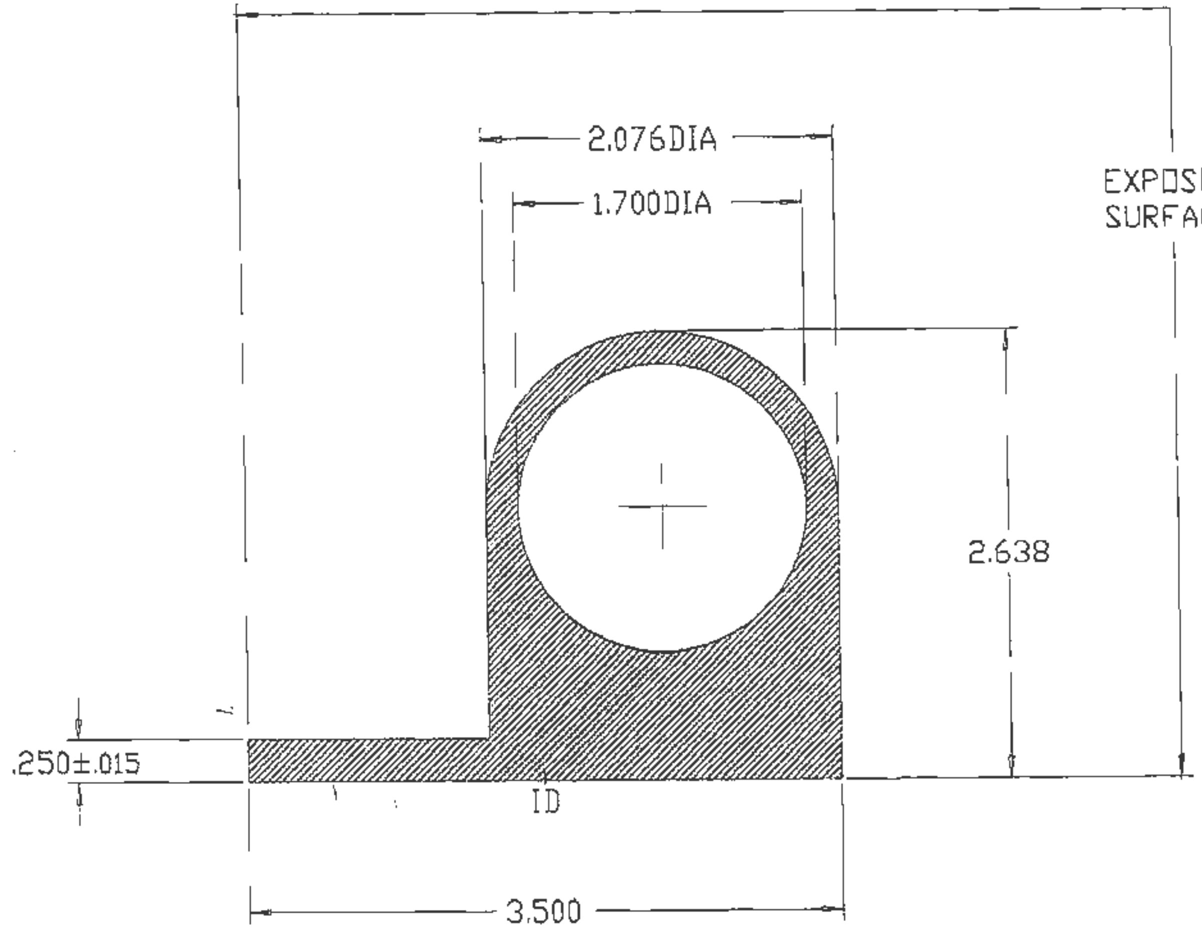
A

DIE NUMBER	45553	
DRAWING NUMBER	A-52842	
LB/FT	3.720	
AREA	3.100	
PERI	16.717	
ADJ PERI	11.376	
CCIFAC	4.0	4
TYPE	HOLLOW	
TIE,VOL	----	
DRN BY	TEG	
DIE SIZE		
FD PLT		
BACKER		
BOLSTER		
SUB BOL		
HOLES		
BILIR/R		
EXP PI		

✳ DENOTES CRITICAL DIMENSION OR TOLERANCE

ALUMINUM ASSOCIATION STANDARD TOLERANCES APPLY U.O.S.

ID = Sapa Extrusions I.D. MARK: .015 R. x .015 DEEP U.O.S.   TYP WALL U.O.S.: .188 *REF*   TYP RAD U.O.S.: .015



ACTUAL SIZE

REV -

THIS IS NOT A SAPA EXTRUSIONS DESIGN. SAPA EXTRUSIONS ACCEPTS NO RESPONSIBILITY OR LIABILITY FOR THE PERFORMANCE OF PRODUCTS PRODUCED THEREFROM. SAPA EXTRUSIONS MAKES NO WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE WITH REGARD TO THE EXTRUSIONS PRODUCED PURSUANT TO THIS DRAWING.

45556
DIE NUMBER
A-52845
DRAWING NUMBER

sapa:®

7933 NE 21st Ave
Portland, OR 97211-0263
(800) 547-0790

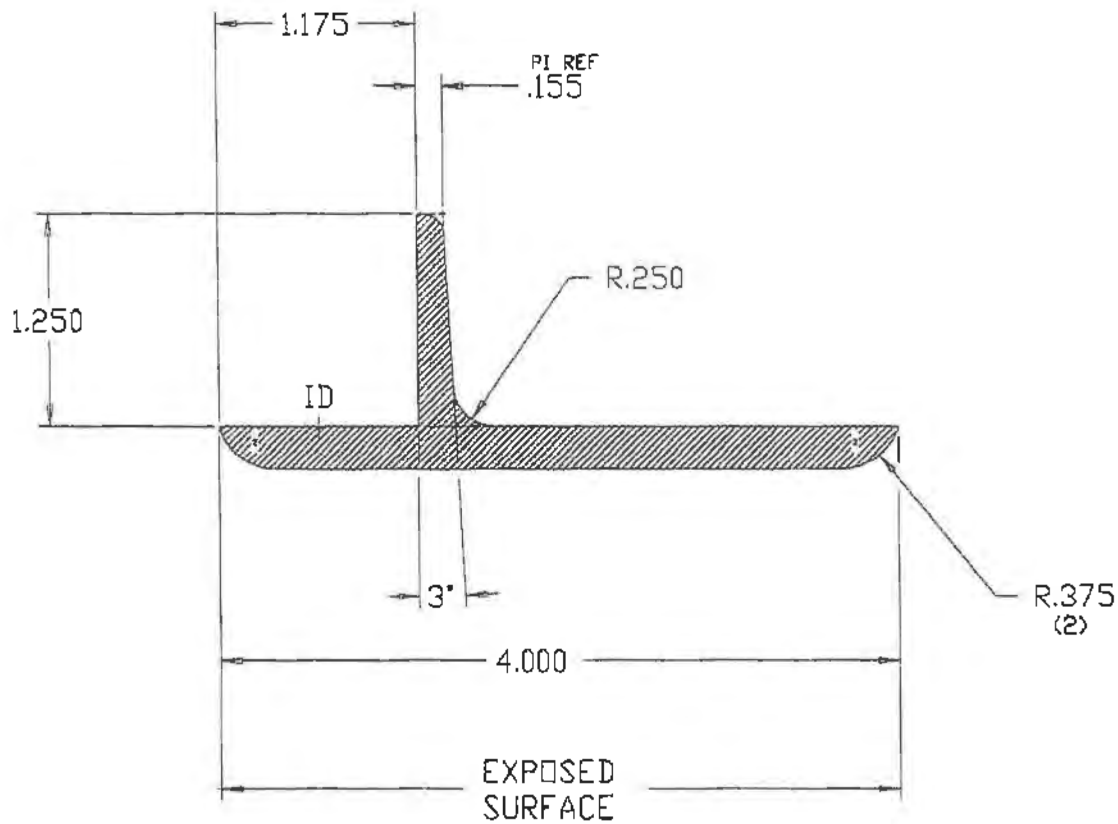
MAG ENTERPRISES LLC	
CUSTOMER NAME	A
PART NAME	
PART NO	DATE 5-11-2012

A

✳ DENOTES CRITICAL DIMENSION OR TOLERANCE

ALUMINUM ASSOCIATION STANDARD TOLERANCES APPLY U.O.S.

ID = Sapa Extrusions I.D. MARK: .015 R. x .015 DEEP U.O.S.   TYP WALL U.O.S.: .250 ±.015   TYP RAD U.O.S.: .015



ACTUAL SIZE

45556	
DIE NUMBER	
A-52845	
DRAWING NUMBER	
LB/FT	1.439
AREA	1.199
PERI	10.512
ADJ PERI	----
CC/FAC	4.1 / 7
TYPE	SOLID
TIE.VOL	----
DRN BY	TEG
DIE SIZE	
FD PLT	
BACKER	
BOLSTER	
SUB BOL	
HOLES	
BIL.IR/R	
EXP PI	

REV 1

THIS IS NOT A SAPA EXTRUSIONS DESIGN. SAPA EXTRUSIONS ACCEPTS NO RESPONSIBILITY OR LIABILITY FOR THE PERFORMANCE OF PRODUCTS PRODUCED THEREFROM. SAPA EXTRUSIONS MAKES NO WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE WITH REGARD TO THE EXTRUSIONS PRODUCED PURSUANT TO THIS DRAWING.

45552 DIE NUMBER B-52841 DRAWING NUMBER

7933 NE 21st Ave
Portland, OR 97211-0263
(800) 547-0790

CUSTOMER NAME	MAG ENTERPRISES LLC
PART NAME	HANDRAIL BRACKET
PART NO	
DATE	5-7-2012

* DENOTES CRITICAL DIMENSION OR TOLERANCE

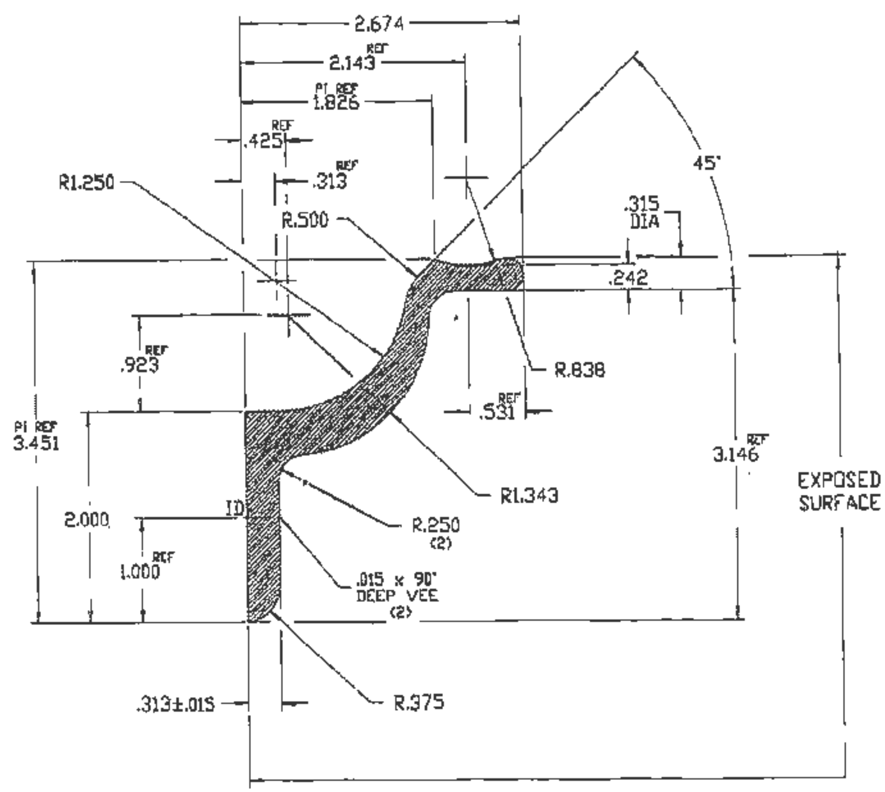
ALUMINUM ASSOCIATION STANDARD TOLERANCES APPLY U.O.S.

ID = Sapa Extrusions I.D. MARK: .015 R. x .015 DEEP U.O.S.   TYP WALL U.O.S.: ----   TYP RAD U.O.S.: .015

DIE NUMBER	45552
DRAWING NUMBER	B-52841
LB/FT	2.020
AREA	1.683
PERI	10.525
ADJ PERI	----
CCIFAC	4.3 | 5
TYPE	SOLID
TIE.VOL	----
DRN BY	TEG
DIE SIZE	
FD PLT	
BACKER	
BOLSTER	
SUB BOL	
HOLES	
BILIR/R	
EXP PI	

THIS IS NOT A SAPA EXTRUSIONS DESIGN. SAPA EXTRUSIONS ACCEPTS NO RESPONSIBILITY OR LIABILITY FOR THE PERFORMANCE OF PRODUCTS PRODUCED THEREFROM. SAPA EXTRUSIONS MAKES NO WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE WITH REGARD TO THE EXTRUSIONS PRODUCED PURSUANT TO THIS DRAWING.

REV -



ACTUAL SIZE

2" DEEP

45554
DIE NUMBER
A-52843
DRAWING NUMBER

sapa:

7933 NE 21st Ave
Portland, OR 97211-0263
(800) 547-0790

CUSTOMER NAME	MAG ENTERPRISES LLC
PART NAME	
PART NO	
DATE	5-7-2012

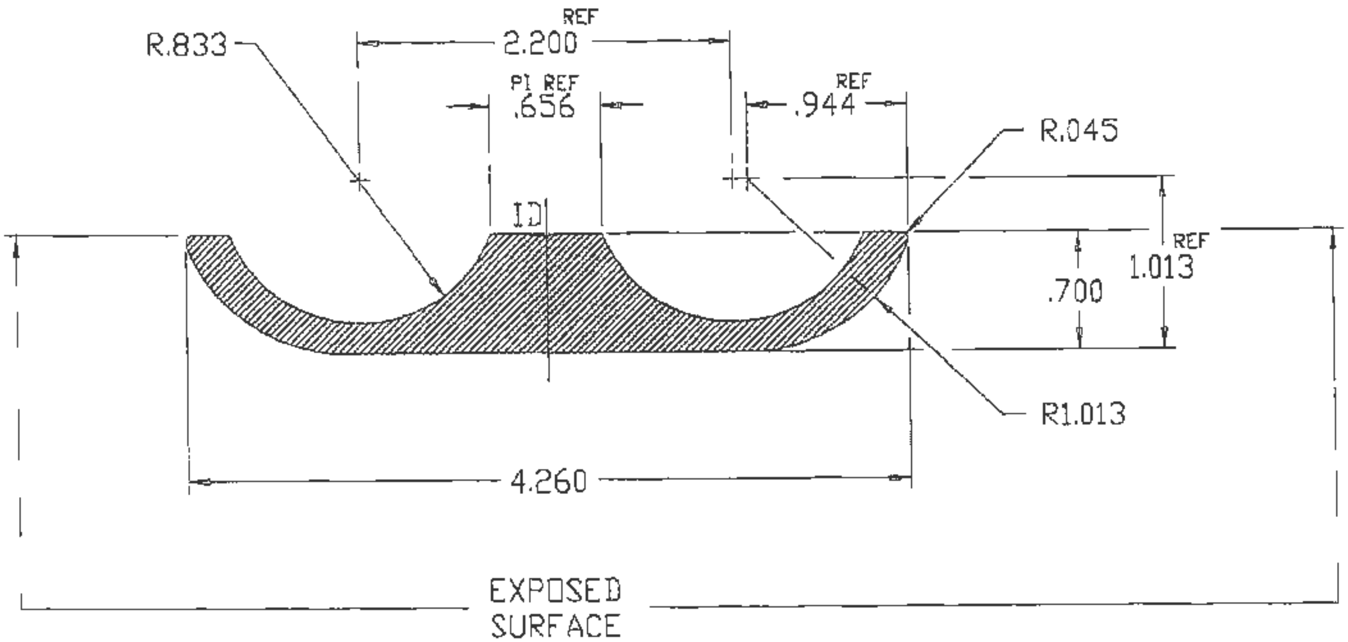
A

✻ DENOTES CRITICAL DIMENSION OR TOLERANCE

ALUMINUM ASSOCIATION STANDARD TOLERANCES APPLY U.O.S.

ID = Sapa Extrusions I.D. MARK: .015 R. x .015 DEEP U.O.S. TYP WALL U.O.S.: ---- TYP RAD U.O.S.: .015

DIE NUMBER	45554
DRAWING NUMBER	A-52843
LB/FT	1.778
AREA	1.482
PERI	10.003
ADJ PERI	----
CCIFAC	4.3 | 6
TYPE	SOLID
TIE.VOL	----
DRN BY	TEG
DIE SIZE	
FD PLT	
BACKER	
BOLSTER	
SUB BOL	
HOLES	
BILIR/R	
EXP PI	



ACTUAL SIZE

REV -

THIS IS NOT A SAPA EXTRUSIONS DESIGN. SAPA EXTRUSIONS ACCEPTS NO RESPONSIBILITY OR LIABILITY FOR THE PERFORMANCE OF PRODUCTS PRODUCED THEREFROM. SAPA EXTRUSIONS MAKES NO WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE WITH REGARD TO THE EXTRUSIONS PRODUCED PURSUANT TO THIS DRAWING.

DIE NUMBER	45555
DRAWING NUMBER	B-52844

sapa:

7933 NE 21st Ave
Portland, OR 97211-0263
(800) 547-0790

CUSTOMER NAME	MAG ENTERPRISES LLC
PART NAME	
PART NO	
DATE	5-7-2012

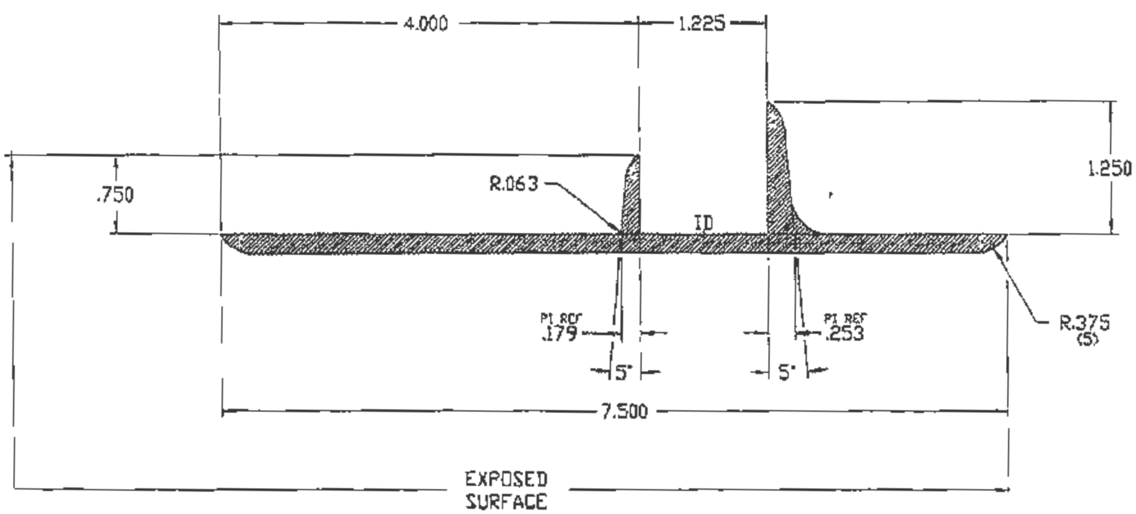
✱ DENOTES CRITICAL DIMENSION OR TOLERANCE

ALUMINUM ASSOCIATION STANDARD TOLERANCES APPLY U.O.S.

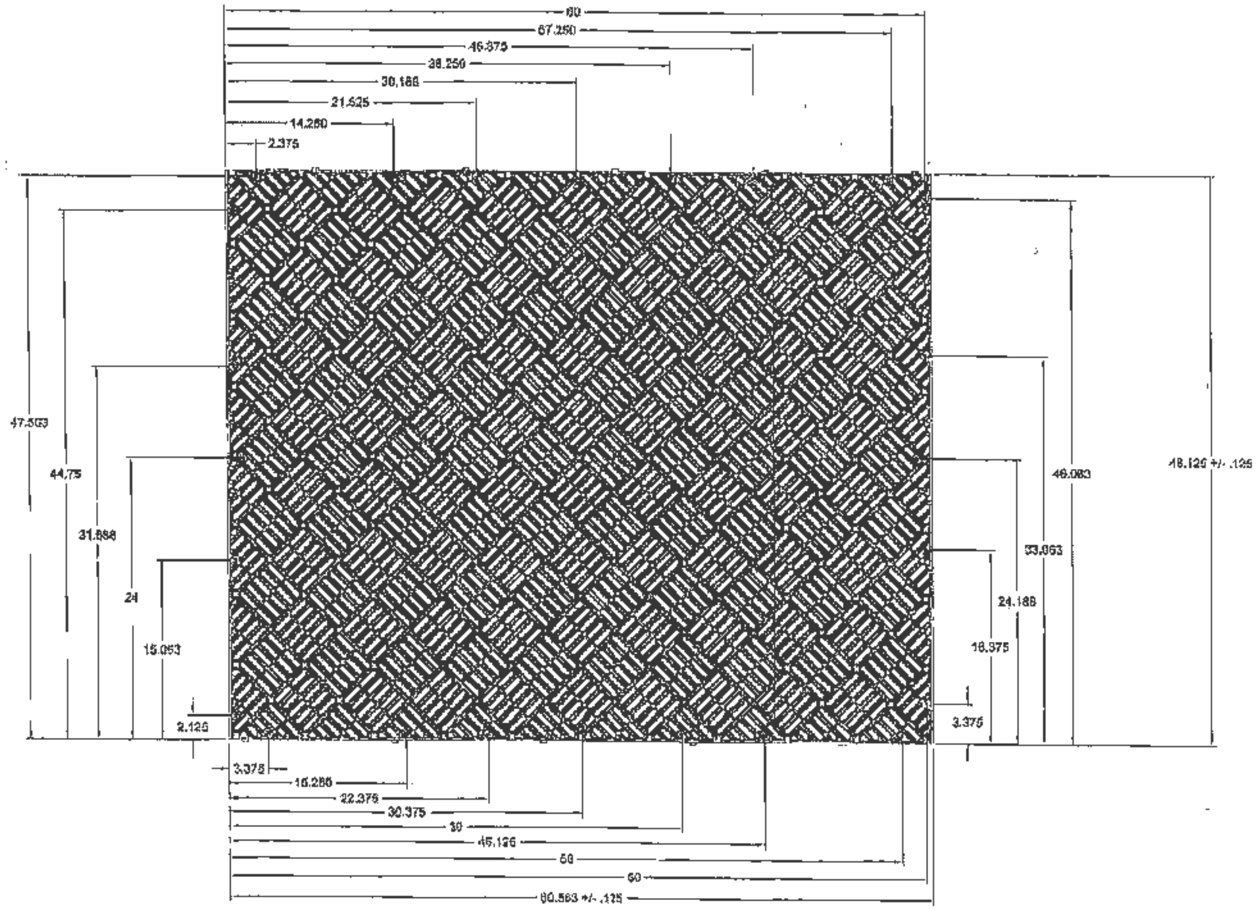
ID = Sapa Extrusions I.D. MARK: .015 R. x .015 DEEP U.O.S. TYP WALL U.O.S.: .188 ±.015 TYP RAD U.O.S.: .015

DIE NUMBER	45555
DRAWING NUMBER	B-52844
LB/FT	2.093
AREA	1.744
PERI	18.671
ADJ PERI	----
CCIFAC	7.6 / 9
TYPE	SOLID
TIEVOL	----
DRN BY	TEG
DIE SIZE	
FD PLT	
BACKER	
BOLSTER	
SUB BOL	
HOLES	
BILLR/R	
EXP PT	

REV 1



ACTUAL SIZE


60
57.250
46.375
38.250
30.188
21.525
14.250
2.375
47.563
44.75
31.688
24
15.063
2.125
3.375
15.250
22.375
30.375
30
45.125
58
60
60.563 +/- .125
48.125 +/- .125
46.083
33.063
24.188
16.375
3.375

SUN WALK 5' X 4' -

Product Specs

	NOMINAL	HIGH IMPACT	GLASS REINFORCED
DIMENTIONS	3' X 4'	35.9" X 47.6" + TABS	36.3" X 48.3" + TABS
	4 'X 4'	47.8" X 47.6" + TABS	48.4" X 48.3" + TABS
	5 'X 4'	59.8" + 47.6" + TABS	60.5" X 48.3" + TABS
WEIGHT	3 'X 4'	14.7 lbs	19.5 lbs
	4 'X 4'	19.6 lbs	26.0 lbs
	5 'X 4'	24.5 lbs	32.5 lbs
SPAN	16" O.C. ALL PRODUCTS		
UV STABILITY	AMINE & HINDERED AMINE ADDITIVES		
SURFACE	SLIP-RESITANT TEXTURE		
A.D.A	COMPLIANT		
LIGHT PENITRATION	INDUSTRY LEADING 43% OPEN AREA (TESTING AVILABE ON REQUEST)		
DEFLECTION	16" O.C. SUPPORT 40 PSI LOAD	0.67"	0.23"
	12" O.C. SUPPORT 40 PSI LOAD	0.30"	0.17"
WARRANTY	12 YEAR LIMITED WARRANTY		

Colours

Sarasota Sand

Cape Cod Grey

White

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB #2020-11 & 12 N. Clack XVII		
SHEET NO 1	OF	
CALCULATED BY MCL	DATE	2/10/2020
CHECKED BY	DATE	
SCALE		

STRUCTURAL CALCULATIONS (PER 2018 IBC) FOR
28' X 64' MODULAR

3/10/2020

REGISTERED PROFESSIONAL ENGINEER
77584
OREGON
MAY 22, 2015
MICHAEL C. LEWIS
EXPIRES: 12/31/2020

MODERN BUILDING SYSTEMS

PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB #2020-11 & 12 N. Clack XVII		
SHEET NO MS-1	OF MS-3	
CALCULATED BY MCL	DATE	2/10/2020
CHECKED BY	DATE	
SCALE		

MATERIAL SUMMARY FOR

28' X 64' MODULAR

ROOF FRAMING:

TYP RF RAFTER	USE	2x10 DF #2 @ 24" O.C.	SEE RF-1
TYP 6'-0" OR LESS OPENING HDR	USE	(2) 2 x 8 DF #2	SEE RF-2
RIDGE BEAM	USE	(2) MURPHY LVL 3100 Fb - 2.0E, 1.5" W (EA) x 24" D	SEE RF-3

COLUMNS:

ENDWALL COLUMNS	USE	(2) 4X6 DF #2	SEE RF-4
MIDSPAN COLUMNS	USE	(2) 3"X3"X3/16" HSS ASTM 500 GRADE B, Fy=46ksi	SEE RF-5
EXTERIOR WALL STUD	USE	2X6 DF STUD GRADE @ 16" O.C.	STUD-1

FLOOR FRAMING:

TYP FLR JOIST	USE	2X8 DF #2 @ 16" O.C.	SEE FLR-1-3
TYP FLR JOIST SUPPORT BEAM	USE	4X8 DF #2	SEE FLR-4

BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB #2020-11 & 12 N. Clack XVII		
SHEET NO MS-2	OF MS-3	
CALCULATED BY MCL	DATE	2/10/2020
CHECKED BY	DATE	
SCALE		

SHEATHING:

ROOF	USE	USE MIN 7/16" SHTG w/ 15 GA STAPLES AT 6" EDGE & 12" FIELD (UNBLOCKED) (ESR-1539, TABLE 6) UPGRADE TO 6" & 8". AT ROOF	SEE LFA-1,2
EXT ENDWALLS	USE	USE MIN 15/32" SHTG w/ 8d (.113) AT 6" EDGE & 12" FIELD (BLOCKED) (ESR-1539, TABLE 8)	SEE LFA-1
EXT SIDEWALLS	USE	USE MIN 15/32" SHTG w/ 8d (.113) AT 6" EDGE & 12" FIELD (BLOCKED) (ESR-1539, TABLE 8)	SEE LFA-2
FLOOR	USE	USE MIN 19/32" SHTG w/ 8d (.113) AT 6" EDGE & 12" FIELD (UNBLOCKED) (ESR-1539, TABLE 6) UPGRADE TO 23/32" SHTG AT 6" & 8". AT FLOOR	SEE LFA-1,2
MOBILE UNIT TO CHASSIS	USE	N/A	SEE FDN-4

MODERN BUILDING SYSTEMS

PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB #2020-11 & 12 N. Clack XVII			
SHEET NO MS-3	OF MS-3		
CALCULATED BY MCL	DATE	2/10/2020	
CHECKED BY	DATE		
SCALE			

SHEAR WALL HOLD DOWNS	USE	USE MIN SIMP CS-18 w/ (4) N-10's EA END	SEE LFA-3
SIDEWALL TOP PLATE SPLICE	USE	USE MIN 4 ft SPLICE w/ (12) 12d's (.131) EA END	SEE LFA-4
ENDWALL TOP PLATE SPLICE	USE	USE MIN SIMP CS-18 w/ (4) N-10's EA END	SEE LFA-4
RIDGE BEAM TO RIDGE BEAM CONNECTIONS	USE	USE MIN (6) - 5/8 in DIA M.B.'s AT RIDGE BEAM	SEE LFA-4

FOUNDATION:

TYP EXT FTG	USE	USE +/- 16 in. SQ. PADS OR 2 x 12 x 24 in. P.T. PADS AT 6' O.C.	SEE FDN-1
TYP INTERIOR FTG	USE	USE +/- 16 in. SQ. PADS OR 2 x 12 x 24 in P.T. PADS AT 6' O.C.	SEE FDN-1
ENDWALL COLUMN FTG	USE	(2) (FLAT) P.T. HF #2, 6 x 8 x 4 ' L	SEE FDN-3,5
CNTR COLUMN FTG	USE	(5) (FLAT) P.T. HF #2, 4 x 8 x 4 ' L	SEE FDN-3,6
CNTR COLUMN FTG POST	USE	(2) DF #2, 6 x 10 x 3 ' L	SEE FDN-3,7
MOD TRANSVERSE ANCHORS	USE	USE MIN (5) HOLD DOWNS AT EA SIDEWALL	SEE FDN-4
MOD LONGITUDINAL ANCHORS	USE	USE MIN (3) HOLD DOWNS AT EA ENDWALL	SEE FDN-4

MODERN BUILDING SYSTEMS, INC.
9493 Porter Road SE * PO Box 110
AUMSVILLE, OREGON 97325
503-749-4949
Fax 503-749-4950

BENDING STRESSES

SHEET NO BS-1	OF	BS-2	
CALCULATED BY MCL		DATE 1/13/2020	
CHECKED BY		DATE	
SCALE			

ALLOWABLE BENDING STRESS $F'_b = F_b\ (C_D\, C_M\, C_t\, C_L\, C_F\, C_{fu}\, C_i\, C_r)$

F_b - BENDING STRESS DESIGN VALUE
C_D - LOAD DURATION FACTOR
C_F - SIZE FACTOR
C_r - REPETITIVE MEMBER FACTOR

BASED ON 2018 NDS

SIZE	SPECIES	M.O.E. (x10^6)	Fb (psi)	C_F	Cr	FLOORS OR ROOFS F'_b w/o DURATION (psi)	C_D (Snow)	ROOFS F'_b w/ DURATION (psi)
JOISTS AND RAFTERS								
2 x 8	DF #1 & Btr	1.8	1200	1.2	1.15	1656	1.15	1904
	DF #1	1.7	1000	1.2	1.15	1380	1.15	1587
	DF #2	1.6	900	1.2	1.15	1242	1.15	1428
	SPF #1 /#2	1.4	875	1.2	1.15	1208	1.15	1389
	HF #2	1.3	850	1.2	1.15	1173	1.15	1349
2 x 10	DF Sel Struct	1.9	1500	1.1	1.15	1898	1.15	2182
	DF #1 & Btr	1.8	1200	1.1	1.15	1518	1.15	1746
	DF #1	1.7	1000	1.1	1.15	1265	1.15	1455
	HF #1	1.5	975	1.1	1.15	1233	1.15	1418
	DF #2	1.6	900	1.1	1.15	1139	1.15	1309
	SPF #1 /#2	1.4	875	1.1	1.15	1107	1.15	1273
	HF #2	1.3	850	1.1	1.15	1075	1.15	1237
HEADERS								
4 x 4	DF #2	1.6	900	1.5	N/A	1350	1.15	1553
4 x 6	DF #2	1.6	900	1.3	N/A	1170	1.15	1346
4 x 8	DF #2	1.6	900	1.3	N/A	1170	1.15	1346
4 x 10	DF #2	1.6	900	1.2	N/A	1080	1.15	1242

TABLE 1—REFERENCE DESIGN PROPERTIES (ALLOWABLE STRESS DESIGN) FOR MURPHY LVL[1,2,3]

PROPERTY		DESIGN STRESS (psi)						
		2,250F_b-1.5E	2,750 F_b-1.8E	2,850 F_b-1.9E	2,950 F_b-2.0E	3,100 F_b-2.0E	3,100 F_b-2.1E	3,100 F_b-2.2E
Bending (F_b)	Joist[4]	2,250	2,750	2,850	2,950	3,100	3,100	3,100
	Plank	2,200	2,750	2,800	2,950	3,100	3,100	3,100
Tension parallel to grain (F_t)[5]		1,350	1,950	1,950	2,100	2,100	2,100	2,100
Longitudinal shear (F_v)	Joist	285	285	285	290	290	290	290
	Plank	150	150	150	150	150	150	150
Compression parallel ($F_{c\parallel}$)		2,350	2,350	2,350	3,200	3,200	3,200	3,200
Compression perpendicular ($F_{c\perp}$)	Joist	750	750	750	750	750	750	750
	Plank	450	450	550	550	550	550	550
Modulus of Elasticity[6], E	Joist	1.5×10^6	1.8×10^6	1.9×10^6	2.0×10^6	2.0×10^6	2.1×10^6	2.2×10^6
	Plank	1.4×10^6	1.8×10^6	1.9×10^6	2.0×10^6	2.0×10^6	2.1×10^6	2.2×10^6

For **SI:** 1 psi = 6.9 kPa.

[1]The tabulated values are design values for normal duration of load. All values, except for E and $F_{c\perp}$, may be adjusted for other load durations as permitted by the code. The design stresses are limited to conditions in which the average equilibrium moisture content of solid-sawn lumber is less than 16 percent.
[2]Reference design values must be adjusted, as applicable, in accordance with Section 8.3 of the NDS.
[3]Joist = load parallel to gluelines. Plank = load perpendicular to gluelines.
[4]The tabulated values are based on a reference depth of 12 inches. For other depths, when loaded edgewise, the allowable bending stress (F_b) shall be modified by $(12/d)^{0.18}$ where d = depth in inches. For depths less than $2^1/_2$ inches, the factor for the $2^1/_2$-inch depth must be used.
[5]The values published in Table 1 are based on a reference length of 3 feet. For other lengths, the allowable tensile stress must be modified by $(3/\ell)^{0.11}$, where ℓ = length in feet. For lengths less than 3 feet, the unadjusted allowable tension stresses in Table 1 are used.
[6]The reference E values are the apparent moduli of elasticity, which include the effects of shear deformation. When calculating total deflection, standard engineering formulae for the pure bending deflection are sufficient.

TABLE 2—FASTENER DESIGN FOR MURPHY LVL: EQUIVALENT SPECIFIC GRAVITY[1]

NAILS				BOLTS	
Withdrawal Load		Lateral Load		Lateral Load	
Installed in Edge	Installed in Face	Installed in Edge	Installed in Face	Installed in Face	
				Parallel to Grain	Perpendicular to Grain
0.49	0.50	0.50	0.50	0.50	0.50

[1]Fastener values based on the equivalent specific gravities in the above table are for normal load duration and may be adjusted using the load duration factors in accordance with the code.

TABLE 3—MINIMUM ALLOWABLE NAIL SPACINGS FOR MURPHY LVL[1]

THICKNESS (in.)	ORIENTATION	NAIL SIZE[2,3] (COMMON OR BOX)	MINIMUM END DISTANCE (in.)	MINIMUM NAIL SPACING (IN.)	
				Single Row	Multiple Rows[4,5]
$1^1/_4 \leq$ thickness $< 1^1/_2$	Edge[6]	8d and smaller	$2^1/_2$	4	NR[8]
		10d and 12d	$2^1/_2$	4	
		16d	$3^1/_2$	5	
	Face[7]	8d and smaller	$1^1/_2$	3	3
		10d and 12d	$1^1/_2$	3	3
		16d	$1^1/_2$	5	5
$\geq 1^1/_2$	Edge[6]	8d and smaller	$2^1/_2$	3	4
		10d and 12d	$3^1/_2$[9]	4	5
		16d	$3^1/_2$	5	6[10]
	Face[7]	8d and smaller	$1^1/_2$	3	3
		10d and 12d	$1^1/_2$	3	3
		16d	$1^1/_2$	5	5

For **SI:** 1 inch = 25.4 mm.

[1]Edge distance must be sufficient to prevent splitting.
[2]16d sinkers (0.148 inch x $3^1/_4$ inches) may be spaced the same as a 12d common wire nail (0.148 inch x $3^1/_4$ inches).
[3]Fastener sizes and closest on-center spacing not specifically described above are beyond the scope of this report.
[4]Multiple rows in the edge orientation must be spaced $^1/_2$ inch or more from each other and offset one-half of the tabulated minimum nail spacing, as shown in Figure 1.
[5]Multiple rows must be equally spaced from the centerline of the narrow face axis.
[6]Nail penetration for edge nailing must not exceed 2 inches for 16d nails (common or box) or $2^1/_2$ inches for 10d and 12d nails (common or box).
[7]Tabulated closest on-center spacing for face orientation is applicable to nails that are installed in rows parallel to the grain (length) of the LVL. For nails installed in rows perpendicular to the direction of grain (width/depth) of the LVL, the closest on-center spacing for face orientation must be sufficient to prevent splitting of the LVL.
[8]Not recommended.
[9]Minimum end distance may be reduced to $2^1/_2$ inches for single row nailing.
[10]Minimum nail spacing may be reduced to 5 inches when the LVL is $1^3/_4$ inches or thicker.

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Project Title: N. Clack XVIII
Engineer: MCL
Project ID: 2020-11 & 12
Project Descr: 28 x 64 Modular Classroom

RF-1 OF RF-5

Printed: 11 FEB 2020, 10:37AM

Wood Beam

File = C:\Projects\ENERCA~4\2020-1~1.CLA\2020-11 and 2020-12 Struct Calcs.ec6

Lic. # : KW-06009251 MODERN BUILDING SYSTEMS

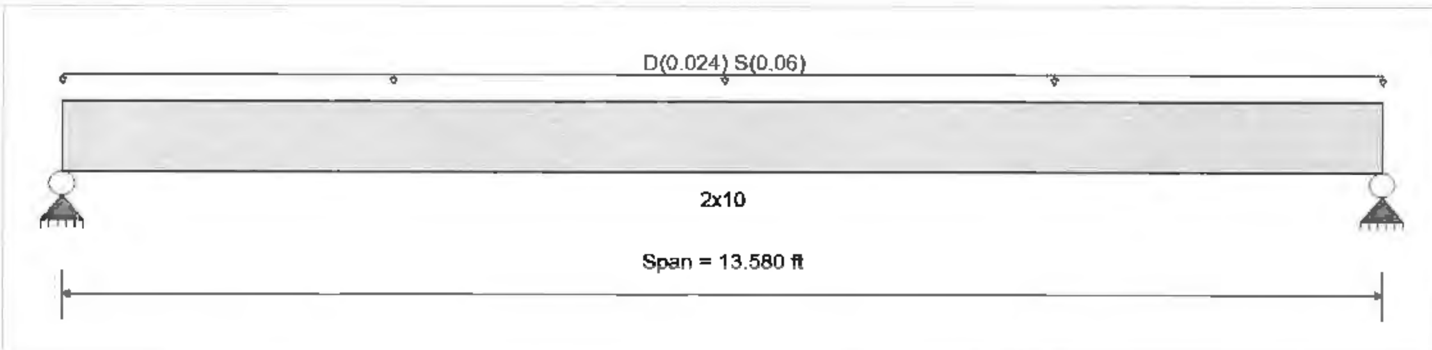
DESCRIPTION: TYP ROOF RAFTER - 2020-11 & 12

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 +	900.0 psi	*E : Modulus of Elasticity*	
Load Combination	IBC 2018	Fb -	900.0 psi	Ebend- xx	1,600.0 ksi
		Fc - Prll	1,350.0 psi	Eminbend - xx	580.0 ksi
Wood Species	: Douglas Fir - Larch	Fc - Perp	625.0 psi		
Wood Grade	: No.2	Fv	180.0 psi		
		Ft	575.0 psi	Density	31.210 pcf
Beam Bracing	: Beam is Fully Braced against lateral-torsional buckling			Repetitive Member Stress Increase	



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
Uniform Load : D = 0.0120, S = 0.030 ksf, Tributary Width = 2.0 ft, (Roof Dead Load and Snow Load)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.747: 1**	Maximum Shear Stress Ratio	=	0.277 : 1
Section used for this span		**2x10**	Section used for this span		**2x10**
	=	1,125.10 psi		=	57.43 psi
	=	1,505.67 psi		=	207.00 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	6.733 ft	Location of maximum on span	=	12.895 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.294 in	Ratio =	554 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.426 in	Ratio =	382 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.591	0.591
Overall MINimum	0.407	0.407
D Only	0.183	0.183
+D+S	0.591	0.591
+D+0.750S	0.489	0.489
+0.60D	0.110	0.110
S Only	0.407	0.407

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Project Title: N. Clack XVIII
Engineer: MCL
Project ID: 2020-11 & 12
Project Descr: 28 x 64 Modular Classroom

RF-2 OF RF-5

Printed: 11 FEB 2020, 10:39AM

Wood Beam

File = C:\Projects\ENERCA~4\2020-1~1.CLA\2020-11 and 2020-12 Struct Calcs.ec6
Software copyright ENERCALC, INC. 1983-2019, Build:12.19.11.29

Lic. # : KW-06009251 MODERN BUILDING SYSTEMS

DESCRIPTION: UP TO 6-'0" OPENING HDR - 2020-11 & 12

CODE REFERENCES

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

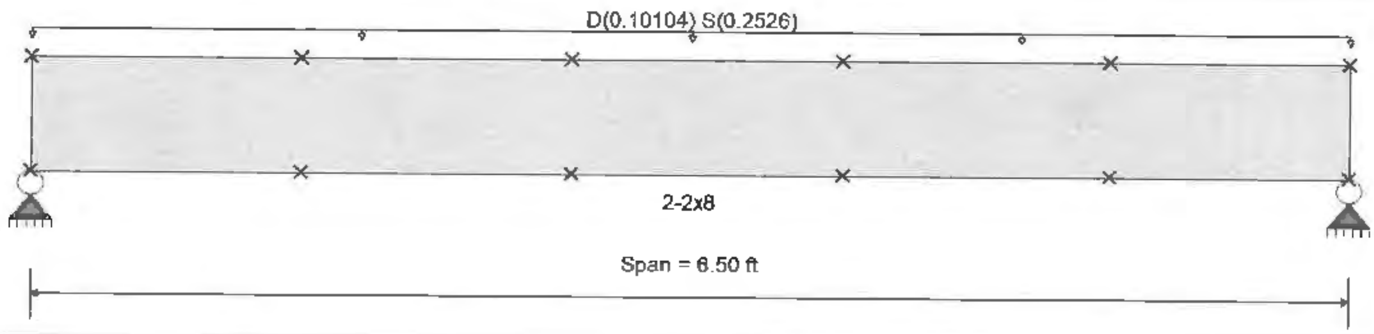
Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900.0 psi	*E : Modulus of Elasticity*	
Load Combination	IBC 2018	Fb -	900.0 psi	Ebend- xx	1,600.0 ksi
		Fc - Prll	1,350.0 psi	Eminbend - xx	580.0 ksi
Wood Species	: Douglas Fir - Larch	Fc - Perp	625.0 psi		
Wood Grade	: No.2	Fv	95.0 psi		
		Ft	575.0 psi	Density	32.210 pcf

Beam Bracing : Beam bracing is defined as a set spacing over all spans

Unbraced Lengths

First Brace starts at ft from Left-Most support
Regular spacing of lateral supports on length of beam = 1.330 ft



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
Uniform Load : D = 0.0120, S = 0.030 ksf, Tributary Width = 8.420 ft, (1/2 Roof span and up to 18" overhang)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.698 : 1	Maximum Shear Stress Ratio	=	0.600 : 1
Section used for this span		2-2x8	Section used for this span		2-2x8
	=	864.44 psi		=	65.50 psi
	=	1,238.85 psi		=	109.25 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	3.223 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.067 in	Ratio =	1156 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.096 in	Ratio =	614 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.165	1.165
Overall MINimum	0.821	0.821
D Only	0.344	0.344
+D+S	1.165	1.165
+D+0.750S	0.960	0.960
+0.60D	0.207	0.207
S Only	0.821	0.821

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Project Title: N. Clack XVIII
Engineer: MCL
Project ID: 2020-11 & 12
Project Descr: 28 x 64 Modular Classroom

RF-3 of RF-5

Printed: 10 FEB 2020, 4:16PM

Wood Beam

File = C:\Projects\ENERCA~4\2020-1~1.CLA\2020-11 and 2020-12 Struct Calcs.ec6 .

Lic. # : KW-06009251 MODERN BUILDING SYSTEMS

DESCRIPTION: (2) LVL RIDGE BEAM - 2020-11 & 12

CODE REFERENCES

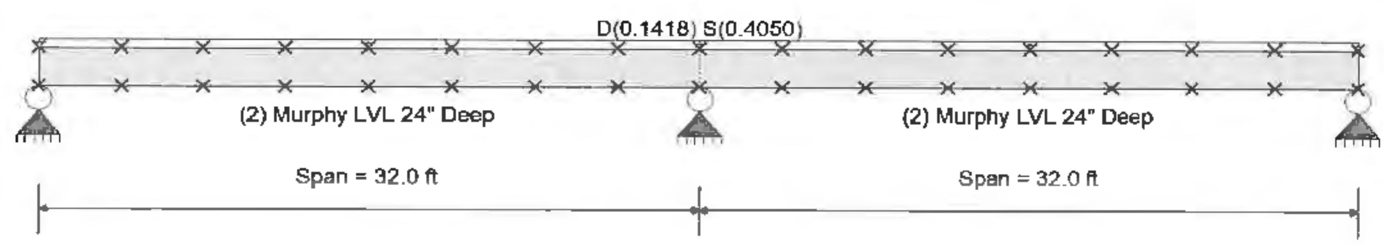
Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2018

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	2,736.0 psi	*E : Modulus of Elasticity*	
Load Combination :	IBC 2018	Fb -	2,736.0 psi	Ebend- xx	2,000.0 ksi
		Fc - Prll	3,200.0 psi	Eminbend - xx	1,800.0 ksi
Wood Species	: Murphy LVL 3100Fb-2.0E x 24" Deep	Fc - Perp	750.0 psi		
Wood Grade	: Manufactured	Fv	290.0 psi		
		Ft	2,100.0 psi	Density	35.0 pcf
Beam Bracing	: Beam bracing is defined as a set spacing over all spans				

Unbraced Lengths

First Brace starts at ft from Left-Most support
Regular spacing of lateral supports on length of beam = 4.0 ft



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
Loads on all spans...
Uniform Load on ALL spans : D = 0.01050, S = 0.030 ksf, Tributary Width = 13.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.986 : 1	Maximum Shear Stress Ratio	=	0.637 : 1
Section used for this span		**(2) Murphy LVL 24" D**	Section used for this span		**(2) Murphy LVL 24" D**
	=	3,009.33 psi		=	212.46 psi
	=	3,053.25 psi		=	333.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	32.000 ft	Location of maximum on span	=	30.074 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.579 in	Ratio =	663 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.806 in	Ratio =	476 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	6.771	22.570	6.771
Overall MINimum	4.860	16.200	4.860
D Only	1.911	6.370	1.911
+D+S	6.771	22.570	6.771
+D+0.750S	5.556	18.520	5.556
+0.60D	1.147	3.822	1.147
S Only	4.860	16.200	4.860

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Project Title: N. Clack XVIII
Engineer: MCL
Project ID: 2020-11 & 12
Project Descr: 28 x 64 Modular Classroom

Printed: 11 FEB 2020, 10:41AM

Wood Column

File = C:\Projects\ENERCA~4\2020-1~1.CLA\2020-11 and 2020-12 Struct Calcs.ec6 .

Lic. # : KW-06009251 MODERN BUILDING SYSTEMS

DESCRIPTION: END COLUMN FOR RIDGE BEAM 1 OF 2 REQ'D EA END - 2020-11 & 12

Code References

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

General Information

Analysis Method :	Allowable Stress Design		
End Fixities	Top & Bottom Pinned		
Overall Column Height		10.170 ft	
(Used for non-slender calculations)			
Wood Species	Douglas Fir - Larch		
Wood Grade	No.2		
Fb +	900.0 psi	Fv	95.0 psi
Fb -	900.0 psi	Ft	575.0 psi
Fc - Prll	1,350.0 psi	Density	32.210 pcf
Fc - Perp	625.0 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1,600.0	1,600.0	1,600.0 ksi
Minimum	580.0	580.0	

Wood Section Name	**4x6**
Wood Grading/Manuf.	Graded Lumber
Wood Member Type	Sawn
Exact Width	**3.50** in
Exact Depth	**5.50** in
Area	19.250 in^2
Ix	48.526 in^4
Iy	19.651 in^4

Allow Stress Modification Factors

Cf or Cv for Bending	1.30
Cf or Cv for Compression	1.10
Cf or Cv for Tension	1.30
Cm : Wet Use Factor	1.0
Ct : Temperature Factor	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0 *NDS 15.3.2*
Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 1 ft, K = 1.0
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 10.170 ft, K =

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 43.791 lbs * Dead Load Factor
AXIAL LOADS . . .
1/2 of Ridge Beam Rxt @ end: Axial Load at 10.170 ft, Xecc = 1.0 in, D = 0.9560, S = 2.430 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS	Max. Axial+Bending Stress Ratio =	**0.2710 : 1**
	Load Combination	+D+S
	Governing NDS Forumla	Comp + Myy, NDS Eq. 3.9-3
	Location of max.above base	10.102 ft
	At maximum location values are . . .	
	Applied Axial	3.430 k
	Applied Mx	0.0 k-ft
	Applied My	-0.2803 k-ft
	Fc : Allowable	817.95 psi
PASS	Maximum Shear Stress Ratio =	**0.01979 : 1**
	Load Combination	+D+S
	Location of max.above base	10.170 ft
	Applied Design Shear	2.162 psi
	Allowable Shear	109.250 psi

Maximum SERVICE Lateral Load Reactions . .

Top along Y-Y	0.0 k	Bottom along Y-Y	0.0 k
Top along X-X	0.02775 k	Bottom along X-X	0.02775 k

Maximum SERVICE Load Lateral Deflections . . .

Along Y-Y 0.0 in at 0.0 ft above base
for load combination : n/a
Along X-X -0.1038 in at 5.938 ft above base
for load combination : +D+S

Other Factors used to calculate allowable stresses . . .

Bending	Compression	Tension

MODERN BUILDING SYSTEMS
PO Box 210 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Project Title: N. Clack XVIII
Engineer: MCL
Project ID: 2020-11 & 12
Project Descr: 28 x 64 Modular Classroom

Printed: 11 FEB 2020, 10:42AM

Steel Column

File = C:\Projects\ENERCA~4\2020-1~1.CLA\2020-11 and 2020-12 Struct Calcs.ec6 .

Lic. # : KW-06009251 MODERN BUILDING SYSTEMS

DESCRIPTION: CNTR COLUMN FOR RIDGE BEAM 1 0F 2 REQ'D - 2020-11 & 12

Code References

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

General Information

Steel Section Name :	**HSS3X3X3/16**
Analysis Method :	Allowable Strength
Steel Stress Grade	
Fy : Steel Yield	46.0 ksi
E : Elastic Bending Modulus	29,000.0 ksi

Overall Column Height 10.170 ft
Top & Bottom Fixity **Top & Bottom Pinned**
Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Unbraced Length for buckling ABOUT Y-Y Axis = 10.170 ft, K = 1.0
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 10.170 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 69.674 lbs * Dead Load Factor
AXIAL LOADS . . .
1/2 OF RIDGE BEAM RXT: Axial Load at 10.170 ft, Xecc = 1.0 in, D = 3.185, S = 8.10 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS	Max. Axial+Bending Stress Ratio =	**0.6551** : 1
	Load Combination	+D+S
	Location of max.above base	10.102 ft
	At maximum location values are . . .	
	Pa : Axial	11.355 k
	Pn / Omega : Allowable	24.083 k
	Ma-x : Applied	0.0 k-ft
	Mn-x / Omega : Allowable	4.522 k-ft
	Ma-y : Applied	-0.9341 k-ft
	Mn-y / Omega : Allowable	4.522 k-ft
PASS	Maximum Shear Stress Ratio =	**0.006488** : 1
	Load Combination	+D+S
	Location of max.above base	0.0 ft
	At maximum location values are . . .	
	Va : Applied	0.09247 k
	Vn / Omega : Allowable	14.252 k

Maximum Load Reactions . .

Top along X-X	0.09247 k
Bottom along X-X	0.09247 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	0.0 ft	above base
for load combination :				
Along X-X	-0.1525 in	at	5.938 ft	above base
for load combination : +D+S				

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Project Title: N. Clack XVIII
Engineer: MCL
Project ID: 2020-11 & 12
Project Descr: 28 x 64 Modular Classroom

STUD-1 OF STUD-1

Printed: 11 FEB 2020, 10:48AM

Wood Column

File = C:\Projects\ENERCA~4\2020-1~1.CLA\2020-11 and 2020-12 Struct Calcs.ec6 .

Lic. # : KW-06009251 MODERN BUILDING SYSTEMS

DESCRIPTION: EXTERIOR WALL STUD ANALYSIS - 2020-11 & 12

Code References

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

General Information

Analysis Method :	Allowable Stress Design		
End Fixities	Top & Bottom Pinned		
Overall Column Height		8.0 ft	
(Used for non-slender calculations)			
Wood Species	Douglas Fir - Larch		
Wood Grade	Stud		
Fb +	700.0 psi	Fv	95.0 psi
Fb -	700.0 psi	Ft	450.0 psi
Fc - Prll	850.0 psi	Density	31.20 pcf
Fc - Perp	625.0 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1,400.0	1,400.0	1,400.0 ksi
Minimum	510.0	510.0	

Wood Section Name	2x6
Wood Grading/Manuf.	Graded Lumber
Wood Member Type	Sawn
Exact Width	1.50 in
Exact Depth	5.50 in
Area	8.250 in^2
Ix	20.797 in^4
Iy	1.547 in^4

Allow Stress Modification Factors	
Cf or Cv for Bending	1.0
Cf or Cv for Compression	1.0
Cf or Cv for Tension	1.0
Cm : Wet Use Factor	1.0
Ct : Temperature Factor	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0 *NDS 15.3.2*
Use Cr : Repetitive ?	Yes

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 1.0 ft, K = 1.0
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8.0 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 14.30 lbs * Dead Load Factor
AXIAL LOADS . . .
SL = 30 psf & up to 18" O.H.: Axial Load at 8.0 ft, Xecc = 1.0 in, D = 0.2410, S = 0.3360 k
BENDING LOADS . . .
Lat. Uniform Load creating Mx-x, W = 0.0640 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS	Max. Axial+Bending Stress Ratio =	**0.5031 : 1**
	Load Combination	+D+0.60W
	Governing NDS Forumla	Comp + Mxx + Myy, NDS Eq. 3.9-
	Location of max.above base	4.242 ft
	At maximum location values are . . .	
	Applied Axial	0.2553 k
	Applied Mx	0.3061 k-ft
	Applied My	-0.01065 k-ft
	Fc : Allowable	945.22 psi
PASS	Maximum Shear Stress Ratio =	**0.1837 : 1**
	Load Combination	+D+0.60W
	Location of max.above base	0.0 ft
	Applied Design Shear	27.927 psi
	Allowable Shear	152.0 psi

Maximum SERVICE Lateral Load Reactions . .

Top along Y-Y	0.2560 k	Bottom along Y-Y	0.2560 k
Top along X-X	0.006010 k	Bottom along X-X	0.006010 k

Maximum SERVICE Load Lateral Deflections . . .

Along Y-Y 0.2048 in at 4.027 ft above base
for load combination : W Only
Along X-X -0.1589 in at 4.671 ft above base
for load combination : +D+S

Other Factors used to calculate allowable stresses . . .

Bending	Compression	Tension

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Project Title: N. Clack XVIII
Engineer: MCL
Project ID: 2020-11 & 12
Project Descr: 28 x 64 Modular Classroom

FLR-1 CF FLR-4

Printed: 11 FEB 2020, 10:55AM

Wood Beam

File = C:\Projects\ENERCA~4\2020-1~1.CLA\2020-11 and 2020-12 Struct Calcs.ec6
Software copyright ENERCALC, INC. 1983-2019, Build:12.19.11.29

Lic. # : KW-06009251 MODERN BUILDING SYSTEMS

DESCRIPTION: TYP FLOOR JOIST- DIST LOAD (OFFICE) - 2020-11 & 12

CODE REFERENCES

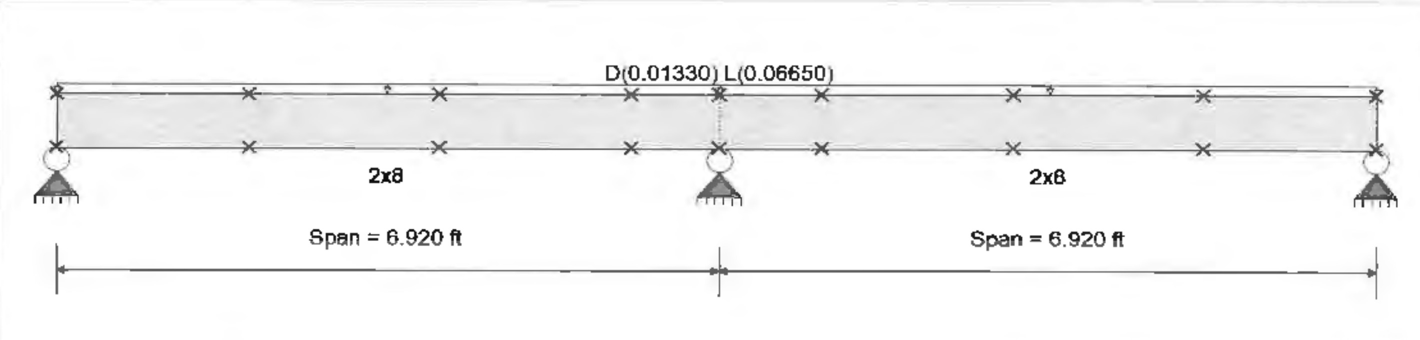
Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2018

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900.0 psi	*E : Modulus of Elasticity*	
Load Combination	IBC 2018	Fb -	900.0 psi	Ebend- xx	1,600.0 ksi
		Fc - Prll	1,350.0 psi	Eminbend - xx	580.0 ksi
Wood Species	: Douglas Fir - Larch	Fc - Perp	625.0 psi		
Wood Grade	: No.2	Fv	95.0 psi		
		Ft	575.0 psi	Density	32.210 pcf
Beam Bracing	: Beam bracing is defined as a set spacing over all spans			Repetitive Member Stress Increase	

Unbraced Lengths

First Brace starts at ft from Left-Most support
Regular spacing of lateral supports on length of beam = 2.0 ft



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
Loads on all spans...
Uniform Load on ALL spans : D = 0.010, L = 0.050 ksf, Tributary Width = 1.330 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.317: 1	Maximum Shear Stress Ratio	=	0.447 : 1
Section used for this span		2x8	Section used for this span		2x8
	=	449.50psi		=	42.46 psi
	=	1,416.05psi		=	95.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	0.000ft	Location of maximum on span	=	6.920 ft
Span # where maximum occurs	=	Span # 2	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.019 in	Ratio =	4363 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.024 in	Ratio =	3528 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	0.213	0.711	0.213
Overall MINimum	0.173	0.575	0.173
D Only	0.041	0.136	0.041
+D+L	0.213	0.711	0.213
+D+0.750L	0.170	0.568	0.170
+0.60D	0.024	0.082	0.024
L Only	0.173	0.575	0.173

Wood Beam

DESCRIPTION: TYP FLOOR JOIST - PT LOAD at CNTR (OFFICE) - 2020-11 & 12

CODE REFERENCES

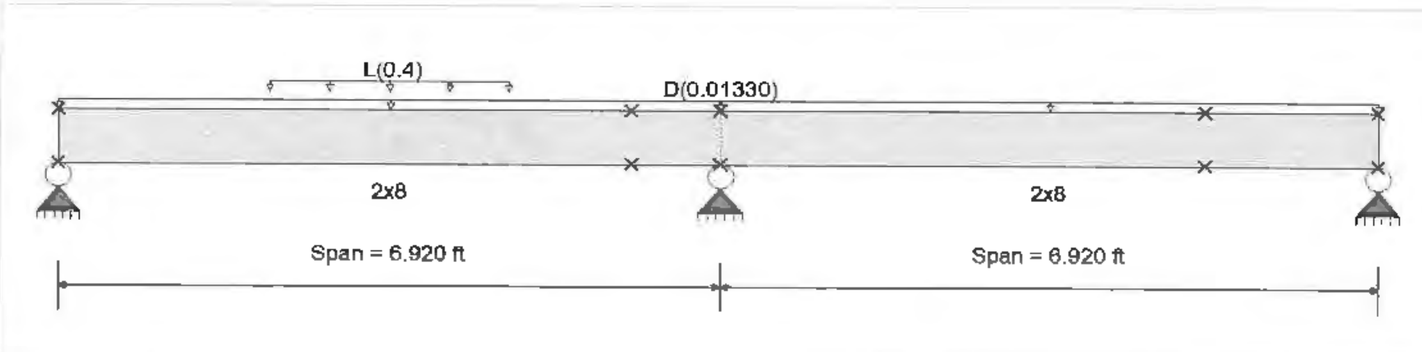
Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2018

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900.0 psi	*E : Modulus of Elasticity*	
Load Combination	IBC 2018	Fb -	900.0 psi	Ebend- xx	1,600.0 ksi
		Fc - Prll	1,350.0 psi	Eminbend - xx	580.0 ksi
Wood Species	: Douglas Fir - Larch	Fc - Perp	625.0 psi		
Wood Grade	: No.2	Fv	95.0 psi		
		Ft	575.0 psi	Density	32.210 pcf
Beam Bracing	: Beam bracing is defined as a set spacing over all spans			Repetitive Member Stress Increase	

Unbraced Lengths

First Brace starts at ft from Left-Most support
Regular spacing of lateral supports on length of beam = 6.0 ft



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
Loads on all spans...
Uniform Load on ALL spans : D = 0.010 ksf, Tributary Width = 1.330 ft
Load for Span Number 1
Uniform Load : L = 0.40 k/ft, Extent = 2.20 -->> 4.70 ft, Tributary Width = 1.0 ft, (2k pt load over 2 joists; 1k on 1 joist (dist))

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.839**: 1	Maximum Shear Stress Ratio	=	**0.939** : 1
Section used for this span		**2x8**	Section used for this span		**2x8**
	=	1,066.63 psi		=	89.25 psi
	=	1,271.74 psi		=	95.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	3.198 ft	Location of maximum on span	=	6.338 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.107 in	Ratio =	776 >=360
Max Upward Transient Deflection	-0.044 in	Ratio =	1881 >=360
Max Downward Total Deflection	0.111 in	Ratio =	745 >=240
Max Upward Total Deflection	-0.040 in	Ratio =	2054 >=240

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	0.453	0.814	-0.090
Overall MINimum	0.412	0.678	-0.026
D Only	0.041	0.136	0.041
+D+L	0.453	0.814	-0.049
+D+0.750L	0.350	0.644	-0.026
+0.60D	0.024	0.082	0.024
L Only	0.412	0.678	-0.090

MODERN BUILDING SYSTEMS

PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Project Title: N. Clack XVIII
Engineer: MCL
Project ID: 2020-11 & 12
Project Descr: 28 x 64 Modular Classroom

FLR-3 OF FLR-4

Printed: 11 FEB 2020, 10:57AM

Wood Beam

File = C:\Projects\ENERCA~4\2020-1~1.CLA\2020-11 and 2020-12 Struct Calcs.ec6 .
Software copyright ENERCALC, INC. 1983-2019, Build:12.19.11.29 .

Lic. # : KW-06009251 MODERN BUILDING SYSTEMS

DESCRIPTION: TYP FLOOR JOIST - PT LOAD at SUPPORT (OFFICE) - 2020-11 & 12

CODE REFERENCES

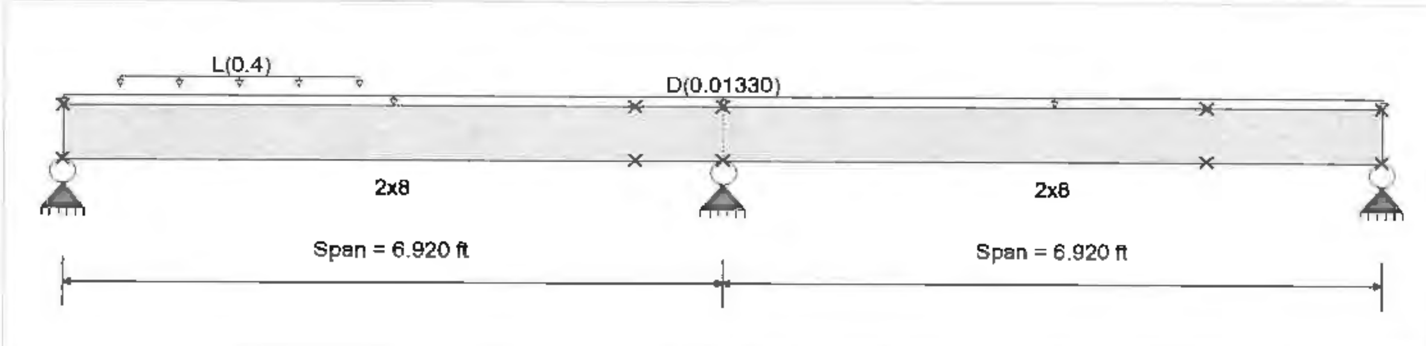
Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2018

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900.0 psi	*E : Modulus of Elasticity*	
Load Combination	IBC 2018	Fb -	900.0 psi	Ebend- xx	1,600.0 ksi
		Fc - Prll	1,350.0 psi	Eminbend - xx	580.0 ksi
Wood Species	: Douglas Fir - Larch	Fc - Perp	625.0 psi		
Wood Grade	: No.2	Fv	110.0 psi		
		Ft	575.0 psi	Density	32.210 pcf
Beam Bracing	: Beam bracing is defined as a set spacing over all spans			Repetitive Member Stress Increase	

Unbraced Lengths

First Brace starts at ft from Left-Most support
Regular spacing of lateral supports on length of beam = 6.0 ft



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
Loads on all spans...
Uniform Load on ALL spans : D = 0.010 ksf, Tributary Width = 1.330 ft
Load for Span Number 1
Uniform Load : L = 0.40 k/ft, Extent = 0.60 -->> 3.10 ft, Tributary Width = 1.0 ft, (2k pt load over 2 joists; 1k on 1 joist (dist))

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.734 : 1	Maximum Shear Stress Ratio	=	0.883 : 1
Section used for this span		2x8	Section used for this span		2x8
	=	932.88 psi		=	97.17 psi
	=	1,271.74 psi		=	110.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	2.268 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.084 in	Ratio =	987 >=360
Max Upward Transient Deflection	-0.029 in	Ratio =	2815 >=360
Max Downward Total Deflection	0.089 in	Ratio =	937 >=240
Max Upward Total Deflection	-0.026 in	Ratio =	3213 >=240

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	0.714	0.523	-0.060
Overall MINimum	0.673	0.387	0.024
D Only	0.041	0.136	0.041
+D+L	0.714	0.523	-0.019
+D+0.750L	0.545	0.426	-0.004
+0.60D	0.024	0.082	0.024
L Only	0.673	0.387	-0.060

MODERN BUILDING SYSTEMS

PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Project Title: N. Clack XVIII
Engineer: MCL
Project ID: 2020-11 & 12
Project Descr: 28 x 64 Modular Classroom

FLR-4 OF FLR-4

Printed: 11 FEB 2020, 10:57AM

Wood Beam

File = C:\Projects\ENERCA~4\2020-1~1.CLA\2020-11 and 2020-12 Struct Calcs.ec6 .
Software copyright ENERCALC, INC. 1983-2019, Build:12.19.11.29 .

Lic. # : KW-06009251 MODERN BUILDING SYSTEMS

DESCRIPTION: TYP FLOOR JOIST- SUPT BEAM (OFFICE) - 2020-11 & 12

CODE REFERENCES

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

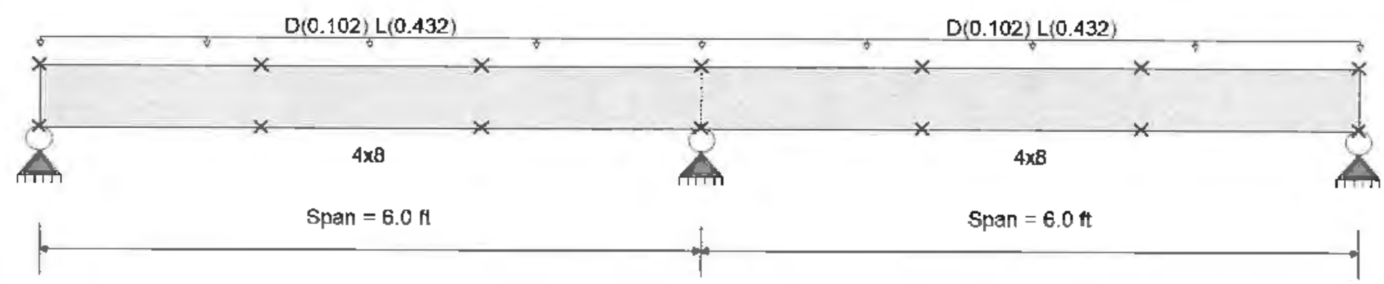
Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900.0 psi	*E : Modulus of Elasticity*	
Load Combination	IBC 2018	Fb -	900.0 psi	Ebend- xx	1,600.0 ksi
		Fc - Prll	1,350.0 psi	Eminbend - xx	580.0 ksi
Wood Species	: Douglas Fir - Larch	Fc - Perp	625.0 psi		
Wood Grade	: No.2	Fv	110.0 psi		
		Ft	575.0 psi	Density	32.210 pcf

Beam Bracing : Beam bracing is defined as a set spacing over all spans

Unbraced Lengths

First Brace starts at ft from Left-Most support
Regular spacing of lateral supports on length of beam = 2.0 ft



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : D = 0.1020, L = 0.4320 , Tributary Width = 1.0 ft, (Joist Rxt 711# @ 1.33' = 535 plf)
Load for Span Number 2
Uniform Load : D = 0.1020, L = 0.4320 , Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.814: 1**	Maximum Shear Stress Ratio	=	**0.927 : 1**
Section used for this span		**4x8**	Section used for this span		**4x8**
	=	950.46 psi		=	101.94 psi
	=	1,166.96 psi		=	110.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	6.000ft	Location of maximum on span	=	6.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.030 in	Ratio =	2404 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.037 in	Ratio =	1924 >=240
Max Upward Total Deflection	0.000 in	Ratio =	0 <240

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	1.214	4.048	1.214
Overall MINimum	0.972	3.240	0.972
D Only	0.242	0.808	0.242
+D+L	1.214	4.048	1.214
+D+0.750L	0.971	3.238	0.971
+0.60D	0.145	0.485	0.145
L Only	0.972	3.240	0.972

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB # 2020-11 & 12 N. Clack XVII	
SHEET NO LFA-1	OF LFA-4
CALCULATED BY MCL	DATE 2/10/2020
CHECKED BY	DATE
SCALE	

SHEAR DIAPHRAGM DESIGN

BUILDING INFORMATION:

BUILDING LENGTH (L) =	64.00 '	
BUILDING WIDTH (B) =	27.67 '	
SHEAR WALL PLATE HEIGHT =	8.00 '	
ROOF OVERHANG =	0.50 '	
TRANSVERSE LOADING	WIND =	10309 #
LONGITUDINAL LOADING	SEISMIC =	3887 #

TRANSVERSE **(WIND CONTROLS)**

WIND = 10309 # ROOF = WIND / 2 = 5155 #

81 plf

64.00 '

Vrf = ROOF / 2 WALLS = 2577 # 2577 #

Lrf = 27.67 '

v rf = 93 plf

<210 plf (WIND) OK

USE MIN 7/16" SHTG w/ 15 GA STAPLES AT 6" EDGE & 12" FIELD (UNBLOCKED) (ESR-1539, TABLE 6) UPGRADE TO 6" & 8". AT ROOF

SHEAR WALL PIER LENGTHS

15.67 '	9.58 '	Lwall = 25.25 '
0.00 '	0.00 '	
0.00 '	0.00 '	v wall = 102 plf

<280 plf (WIND) OK

USE MIN 15/32" SHTG w/ 8d (.113) AT 6" EDGE & 12" FIELD (BLOCKED) (ESR-1539, TABLE 8)

Vflr = 2577 #

Lflr = 27.67 '

v flr = 93 plf

<265 plf (WIND) - OK

USE MIN 19/32" SHTG w/ 8d (.113) AT 6" EDGE & 12" FIELD (UNBLOCKED) (ESR-1539, TABLE 6) UPGRADE TO 23/32" 5HTG AT 6" & 8". AT FLOOR

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

SHEAR DIAPHRAGM DESIGN (CON'T)

LONGITUDINAL **(SEISMIC CONTROLS)**

SEISMIC ROOF = 3887 #

140 plf

27.67 '

Vrf = ROOF / 2 WALLS = 1944 # 1944 #

Lrf = 64.00 '

v rf = 30 plf

<110 plf (CASE 3) (SEISMIC) OK

USE MIN 7/16" SHTG w/ 1S GA STAPLES AT 6" EDGE & 12" FIELD (UNBLOCKED) (ESR-1539, TABLE 6) UPGRADE TO 6" & 8". AT ROOF

SHEAR WALL PIER LENGTHS

8.00 '	5.00 '
5.00 '	8.00 '
0.00 '	0.00 '

Lwall = 26.00 '

v wall = 75 plf

<200 plf (SEISMIC) OK

USE MIN 15/32" SHTG w/ 8d (.113) AT 6" EDGE & 12" FIELD (BLOCKED) (ESR-1539, TABLE 8)

Vflr = 1944 #

Lflr = 64.00 '

v flr = 30 plf

<140 plf (CASE 3) (SEISMIC) - OK

USE MIN 19/32" SHTG w/ 8d (.113) AT 6" EDGE & 12" FIELD (UNBLOCKED) (ESR-1539, TABLE 6) UPGRADE TO 23/32" SHTG AT 6" & 8". AT FLOOR

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

SHEARWALL HOLD DOWNS (TRANSVERSE)

UNIT SHEAR = 102 plf
PIER WIDTH = 9.58 '
ROOF TRIB WIDTH = 3.00 '

Mot = 102plf X 9.58' X 8' = 7823 lb-ft

Mr = [3'(12psf)+8'(10psf)] X 9.58'^2/2 X 0.6 3194 lb-ft

T=C=M/b (7823 - 3194)lb-ft / (9.58 - 0.5)' 510 #

PER NAIL VALUE (SIMP C-2017 PG 305) 171 # DF

N = 510# / 171# EA = 4 NAILS 4 (MIN)

USE MIN SIMP CS-18 w/ (4) N-10's EA END

SHEARWALL HOLD DOWNS (LONGIT)

UNIT SHEAR = 75 plf
PIER WIDTH = 5.00 '
ROOF TRIB WIDTH = 7.42 '

Mot = 75plf X 5' X 8' = 2990 lb-ft

Mr = [7.42'(12psf)+8'(10psf)] X 5'^2/2 X 0.6 1267 lb-ft

T=C=M/b (2990 - 1267)lb-ft / (5 - 0.5)' 383 #

PER NAIL VALUE (SIMP C-2017 PG 305) 171 # DF

N = 383# / 171# EA = 4 NAILS 4 (MIN)

USE MIN SIMP CS-18 w/ (4) N-10's EA END

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

SIDEWALL TOP PLATE SPLICE

T=C=M/b (81plf X 64'^2)/(8 X 27.67') 1490 #

PER NAIL VALUE (NDS 2015 TABLE 12N, Cd=1.6) = 155 # DF

N = 1490# / 155# EA = 12 NAILS 12 (MIN)

USE MIN 4 ft SPLICE w/ (12) 12d's (.131) EA END

ENDWALL TOP PLATE SPLICE

T=C=M/b (140plf X 27.67'^2)/(8 X 64') 209 #

PER NAIL VALUE (SIMP C-2017 PG 305) 171 # DF

N = 209# / 171# EA = 4 NAILS 4 (MIN)

USE MIN SIMP CS-18 w/ (4) N-10's EA END

SHEAR TRANSFER AT M.L.

$$v = \frac{Vay'}{I} = \frac{2577\# \text{ X } (64' \text{ X } 27.67' / 2)(27.67' / 4)}{(64' \text{ X } 27.67'^3) / 12} = \quad 140 \text{ plf}$$

V = 140plf X (64'/2) / 2 X 2 = 4471 #

PER BOLT VALUE (NDS 2015 TABLE 12A) (600# X 1.6)= 960 # LVL or GLB: G=0.50

N= 4471# / 960# EA = 6 BOLTS 6 (MIN)

USE MIN (6) - 5/8 in DIA M.B.'s AT RIDGE BEAM

MODERN BUILDING SYSTEMS

PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB # 2020-11 & 12 N. Clack XVII	
SHEET NO FDN-1	OF FDN-7
CALCULATED BY MCL	2/10/2020
CHECKED BY	DATE

FOUNDATION DESIGN — MODULAR

BUILDING LENGTH (L) =	64.00 '	SITE TYPE =	GRAVEL
BUILDING WIDTH (B) =	27.67 '	MAX BRG PRESSURE =	1800 psf
FRAME RAIL OFFSET =	N/A		
FLOOR TRIB WIDTH =	6.92 '		
ROOF OVERHANG =	0.50 '		
ROOF TRIB WIDTH =	7.42 '		
WALL PLATE HEIGHT =	8.00 ' (ABOVE F.F.)		
TRANSVERSE WIND/SEIS. =	10309 #		
LONGIT. WIND/SEIS. =	5294 #		
WIND UPLIFT =	25518 #		
SNOW LOAD =	25 psf		
BUILDING WEIGHT =	42760 # (No Snow)		
F.F. HEIGHT	2.50 ' (ABOVE GRADE)		
AVG. ROOF HEIGHT	13.00 ' (ABOVE GRADE)		
PIER PAD AREA	1.78 ft^2		

AT EXTERIOR FTG

LOAD TO SKIRTWALL 0 plf

DL = 7.42'(12 psf)+8'(10 psf)+6.92'/2(10 psf) = 204 plf
LL = 6.92' / 2 X 50 psf = 173 plf
SL = 7.42' X 25 psf = 185 plf
D + L = 376 plf
D + S = 389 plf
D + 0.75L +0.75S = 472 plf **CONTROLS**

PIER SPACING = 6.00 '
q = (472plf - 0plf) X (6') / 1.78 ft^2 = 1592 psf
∴ OK on GRAVEL

USE +/- 16 in. SQ. PADS OR 2 x 12 x 24 in. P.T. PADS AT 6' O.C.

AT INTERIOR FTG

DL = 6.92' (10 psf) = 69 plf
LL = 6.92' (50 psf) = 346 plf

D + L = 415 plf **CONTROLS**

PIER SPACING = 6.00 '
q = 415plf X (6') / 1.78 ft^2 = 1399 psf
∴ OK on GRAVEL

USE +/- 16 in. SQ. PADS OR 2 x 12 x 24 in P.T. PADS AT 6' O.C.

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

AT ENDWALL COLUMN FTG

COLUMN DL = 1911 #
COLUMN SL = 4050 #
DL = [3' (10 psf) + 10.5' (10 psf)] X 6.92' = 934 #
LL = 3' (50 psf) X 6.92' = 1037 #

D + L = 3882 #
D + S = 6895 # **CONTROLS**
D + 0.75L +0.75S = 6660 #
<9000# Therefore OK. (See FDN- 3,5)

AT MIDSPAN COLUMN FTG

COLUMN DL = 6370 #
COLUMN SL = 13500 #
DL = 6.92' (10 psf) (6') = 415 #
LL = 6.92' (50 psf) (6') = 2075 #

D + L = 8859 #
D + S = 20285 # **CONTROLS**
D + 0.75L +0.75S = 18466 #
<21600# Therefore OK. (See FDN- 3,6,7)

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB # 2020-11 & 12 N. Clack XVII

SHEET NO FDN-3	OF FDN-7
CALCULATED BY MCL	2/10/2020
CHECKED BY	DATE
SCALE	

@ ENDWALL COLUMN FOOTING

TRY 2 (FLAT) P.T. HF #2, 6 x 8 x 4.00 ' L

Width (b) each = 0.63 '

Pmax = 1800psf X 2 X 0.63' X 4' = 9000 #

DL % = 41%
SL % = 59%

w_{DL} = 1800psf X 0.63' X 0.41 = 464 plf
w_{SL} = 1800psf X 0.63' X 0.59 = 661 plf

@ MIDSPAN COLUMN FOOTING

TRY 5 (FLAT) P.T. HF #2, 4 x 8 x 4.00 ' L

Width (b) each = 0.60 '

Pmax = 1800psf X 5 X 0.6' X 4' = 21600 #

DL % = 33%
SL % = 67%

W_{DL} = 1800psf X 0.6' X 0.33 = 361 plf

W_{SL} = 1800psf X 0.6' X 0.67 = 719 plf

@ MIDSPAN INTERMEDIATE POST

TRY 2 DF #2, 6 x 10 x 3.00 ' L

Width (b) each = 0.46 '

w_{DL} = 1800psf X 4' X 0.33 / 2 MEMBERS = 1204 plf
w_{SL} = 1800psf X 4' X 0.67 / 2 MEMBERS = 2396 plf

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB # 2020-11 & 12 N. Clack XVII	
SHEET NO FDN-4	OF FDN-7
CALCULATED BY MCL	2/10/2020
CHECKED BY	DATE
SCALE	

MOD TRANSVERSE LOADING ANCHORAGE

N = 10309# /2094# = 5 ANCHORS

Mot = 10309# / 2 X 13' + 10309# / 2 X 2.5' + 25518# X 27.67' / 2 = 433 k-ft

Mr = 42760# X 27.67' / 2 = 592 k-ft

w/ ANCHORS = 5 X 2094# X 27.67' = 290 k-ft

TOTAL = (592k-ft X 0.6) + 290k-ft = 645 k-ft
> 433k-ft therefore OK

MIN NUMBER = 5 ANCHORS

USE MIN (5) HOLD DOWNS AT EA SIDEWALL

MOD LONGITUDINAL LOADING ANCHORAGE

N = 5294# /2094# = 3 ANCHORS

Mot = 5294# / 2 X 13' + 5294# / 2 X 2.5 ' + 25518# X 64' / 2 = 858 k-ft

Mr = 42760# X 64' / 2 = 1368 k-ft

w/ ANCHORS = 3 X 2094# X 64' = 402 k-ft

TOTAL = (1368k-ft X 0.6) + 402k-ft = 1223 k-ft
> 858k-ft therefore OK

MIN NUMBER = 3

USE MIN (3) HOLD DOWNS AT EA ENDWALL

MOBILE UNIT CONNECTION TO CHASSIS

(TRANSVERSE LOADING) T = 433 k-ft - (0.6) X 592 k-ft / 27.67 ft /2 = 1409 #
PER STRAP

PER NAIL VALUE (SIMP C-2017 PG 302) 211 # DF

N= 12 NAILS 12 (MIN)

N/A

Modern Building Systems
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Project Title: N. Clack XVIII
Engineer: MCL
Project ID: 2020-11 & 12
Project Descr: 28 x 64 Modular Classroom

FDN-5 OF FDN-7

Printed: 11 FEB 2020, 10:59AM

Wood Beam

File = C:\Projects\ENERCA~4\2020-1~1.CLA\2020-11 and 2020-12 Struct Calcs.ec6 .
Software copyright ENERCALC, INC. 1983-2019, Build:12.19.11.29 .

Lic. # : KW-06009251 MODERN BUILDING SYSTEMS

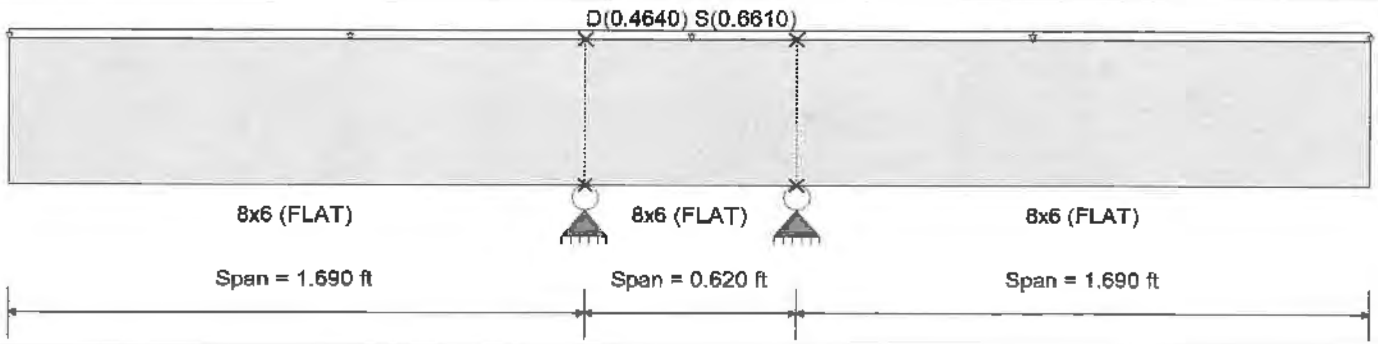
DESCRIPTION: ENDWALL COLUMN FTG - 2020-11 & 12

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 +	675.0 psi	*E : Modulus of Elasticity*	
Load Combination :	IBC 2018	Fb -	675.0 psi	Ebend- xx	1,100.0 ksi
		Fc - Prll	500.0 psi	Eminbend - xx	400.0 ksi
Wood Species	: Hem Fir	Fc - Perp	405.0 psi		
Wood Grade	: No.2	Fv	95.0 psi		
		Ft	350.0 psi	Density	27.70 pcf
Beam Bracing	: Completely Unbraced				



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Loads on all spans...
Uniform Load on ALL spans : D = 0.4640, S = 0.6610 k/ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.657**: 1	Maximum Shear Stress Ratio	=	**0.463** : 1
Section used for this span		**8x6 (FLAT)**	Section used for this span		**8x6 (FLAT)**
	=	509.85psi		=	50.55 psi
	=	776.25psi		=	109.25 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	1.690ft	Location of maximum on span	=	1.236 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.018 in	Ratio =	2312 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.030 in	Ratio =	1358 >=240
Max Upward Total Deflection	-0.001 in	Ratio =	6453 >=240

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Overall MAXimum		2.250	2.250	
Overall MINimum		1.322	1.322	
D Only		0.928	0.928	
+D+S		2.250	2.250	
+D+0.750S		1.920	1.920	
+0.60D		0.557	0.557	
S Only		1.322	1.322	

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Project Title: N. Clack XVIII
Engineer: MCL
Project ID: 2020-11 & 12
Project Descr: 28 x 64 Modular Classroom

FDH-6 OF FDH-7

Printed: 11 FEB 2020, 11:00AM

Wood Beam

File = C:\Projects\ENERCA~4\2020-1~1.CLA\2020-11 and 2020-12 Struct Calcs.ec6

Lic. # : KW-06009251 MODERN BUILDING SYSTEMS

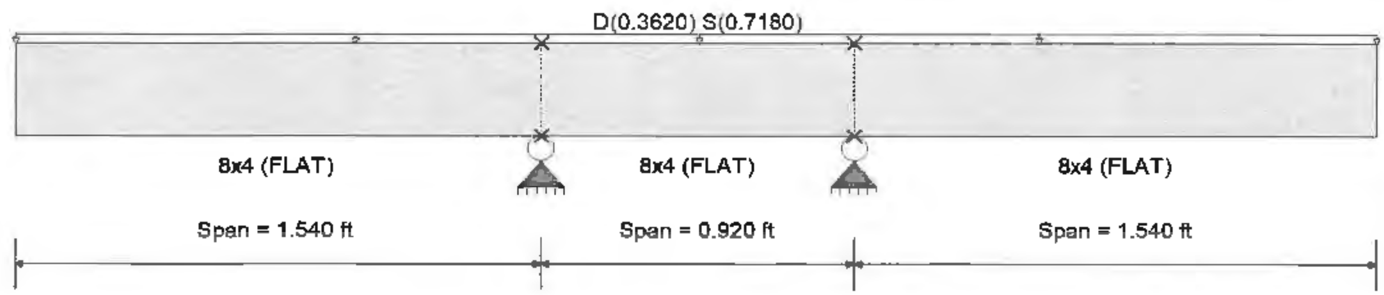
DESCRIPTION: CNTR COLUMN FTG - 2020-11 & 12

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 +	1,160.0 psi	*E : Modulus of Elasticity*	
Load Combination :	IBC 2018	Fb -	1,160.0 psi	Ebend- xx	1,300.0 ksi
		Fc - Prll	1,300.0 psi	Eminbend - xx	470.0 ksi
Wood Species	: Hem Fir	Fc - Perp	425.0 psi		
Wood Grade	: No.2	Fv	95.0 psi		
		Ft	551.0 psi	Density	27.70 pcf
Beam Bracing	: Completely Unbraced				



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Loads on all spans...
Uniform Load on ALL spans : D = 0.3620, S = 0.7180 k/ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.778: 1	Maximum Shear Stress Ratio	=	0.734 : 1
Section used for this span		8x4 (FLAT)	Section used for this span		8x4 (FLAT)
	=	1,038.23psi		=	80.14 psi
	=	1,334.00psi		=	109.25 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	1.540ft	Location of maximum on span	=	1.255ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.055 in	Ratio =	670 >=360
Max Upward Transient Deflection	-0.004 in	Ratio =	2536 >=360
Max Downward Total Deflection	0.083 in	Ratio =	444 >=240
Max Upward Total Deflection	-0.007 in	Ratio =	1686 >=240

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Overall MAXimum		2.160	2.160	
Overall MINimum		1.436	1.436	
D Only		0.724	0.724	
+D+S		2.160	2.160	
+D+0.750S		1.801	1.801	
+0.60D		0.434	0.434	
S Only		1.436	1.436	

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Project Title: N. Clack XVIII
Engineer: MCL
Project ID: 2020-11 & 12
Project Descr: 28 x 64 Modular Classroom

Printed: 11 FEB 2020, 11:00AM

Wood Beam

File = C:\Projects\ENERCA~4\2020-1~1.CLA\2020-11 and 2020-12 Struct Calcs.ec6 .

Lic. # : KW-06009251 MODERN BUILDING SYSTEMS

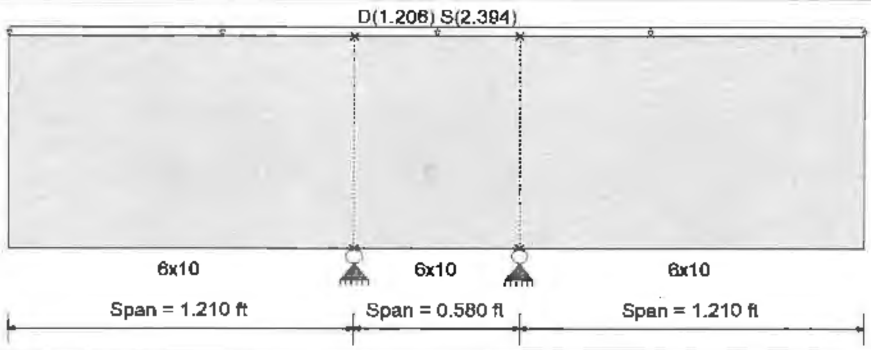
DESCRIPTION: CNTR COLUMN FTG INTERMEDIATE POST- 2020-11 & 12

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2015

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	875.0 psi	*E : Modulus of Elasticity*	
Load Combination	IBC 2015	Fb -	875.0 psi	Ebend- xx	1,300.0 ksi
		Fc - Prll	600.0 psi	Eminbend - xx	470.0 ksi
Wood Species	: Douglas Fir - Larch	Fc - Perp	625.0 psi		
Wood Grade	: No.2	Fv	95.0 psi		
		Ft	425.0 psi	Density	32.210 pcf
Beam Bracing	: Completely Unbraced				



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Loads on all spans...
Uniform Load on ALL spans : D = 1.206, S = 2.394 k/ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.380: 1**	Maximum Shear Stress Ratio	=	**0.750 : 1**
Section used for this span		**6x10**	Section used for this span		**6x10**
	=	**382.27psi**		=	**81.97 psi**
	=	**1,005.39psi**		=	**109.25 psi**
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	1.210ft	Location of maximum on span	=	0.793 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.004 in	Ratio =	6942 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.006 in	Ratio =	4616 >=240
Max Upward Total Deflection	-0.000 in	Ratio =	19173 >=240

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Overall MAXimum		5.400	5.400	
Overall MINimum		3.591	3.591	
D Only		1.809	1.809	
+D+S		5.400	5.400	
+D+0.750S		4.502	4.502	
+0.60D		1.085	1.085	
S Only		3.591	3.591	

MODERN BUILDING SYSTEMS

PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB #	2020-11 & 12 N. Clack XVII		
SHEET NO	L-1	OF	L-5
CALCULATED BY	MCL	DATE	2/11/2020
CHECKED BY		DATE	
SCALE			

WIND ANALYSIS FOR ENCLOSED SIMPLE DIAPHRAGM LOW-RISE BUILDINGS - BASED ON IBC 2018 / ASCE 7-16 CHAPTER 28, PART 2

INPUT DATA

Risk Category =	RC	II		(Table 1.5-1)
Basic Wind Speed =	Vult	140	Vasd =108	mph (3 sec gust)(Fig 26.5-1)
Exposure Category =	EC	B		(Sec. 26.7)
Topographic Factor =	Kzt	1.00		(Sec. 26.8 & 26.8-1)
Adjustment Factor =	Lambda	1.00		(Sec 28.6-1)
Building Length =	L	64.00	ft	
Building width =	B	27.67	ft	10:28:33 AM
Building Height to Eave =	he	11.00	ft	
Building Height to Ridge =	hr	15.00	ft	
Eave Overhang	oh	0.50	ft	
Building End Zone =	a	3.00	ft	
Roof Pitch =	RP	2.0	:12	
Approx. Roof Angle =	RA	10	degrees	(Ref. Fig. 28.6-1)

OUTPUT

Wind Pressure, ps30 (Fig. 28.6-1)

Horizontal	A-ps30	35.10	psf
Horizontal	B-ps30	-14.50	psf
Horizontal	C-ps30	23.30	psf
Horizontal	D-ps30	-8.50	psf
Vertical	E-ps30	-37.30	psf
Vertical	F-ps30	-22.80	psf
Vertical	G-ps30	-26.00	psf
Vertical	H-ps30	-17.50	psf
O.H.	Eoh-ps30	-52.30	psf
O.H.	Goh-ps30	-40.90	psf

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB #	2020-11 & 12 N. Clack XVII		
SHEET NO	L-2	OF	L-5
CALCULATED BY	MCL	DATE	2/11/2020
CHECKED BY		DATE	
SCALE			

Wind Pressure, ps

ps = Lambda * Kzt * ps30

				Min Loading
Horizontal	A-ps	35.10	psf	16.00
Horizontal	B-ps	-14.50	psf	8.00
Horizontal	C-ps	23.30	psf	16.00
Horizontal	D-ps	-8.50	psf	8.00
Vertical	E-ps	-37.30	psf	0.00
Vertical	F-ps	-22.80	psf	0.00
Vertical	G-ps	-26.00	psf	0.00
Vertical	H-ps	-17.50	psf	0.00
O.H.	Eoh-ps	-52.30	psf	
O.H.	Goh-ps	-40.90	psf	

CASE A - Transverse Wind

			Min Loading
	A-tw	2317 lbs	1056 lbs
Set to 0	B-tw	-348 lbs	192 lbs
	C-tw	14865 lbs	10208 lbs
Set to 0	D-tw	-1972 lbs	1856 lbs
Total		17182 lbs (SD)	13312 lbs
Convert to ASD x		0.6	0.6
Total Force on building side L =		**10309** **lbs (ASD)**	**7987** lbs

CASE B - Longitudinal Wind

	A-lw	1211 lbs	552 lbs
	C-lw	7612 lbs	5227 lbs
Total		8823 lbs (SD)	5779 lbs
Convert to ASD x		0.6	0.6
Total Force on building end B =		**5294** **lbs (ASD)**	**3468** lbs

CASE A - Transverse Uplift

w/ gable end OH uplift	E-up	-3354 lbs
w/ gable end OH uplift	F-up	-2050 lbs
w/ gable end OH uplift	G-up	-21043 lbs
w/ gable end OH uplift	H-up	-14164 lbs
sidewall eaves OH uplift	Eoh-up	-225 lbs
sidewall eaves OH uplift	Goh-up	-1694 lbs
Total		**-42530 lbs (SD)**
Convert to ASD x		0.6
Total Uplift Force =		**-25518 lbs (ASD)**

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

JOB #2020-11 & 12 N. Clack XVII			
SHEET NO	L-3	OF	L-5
CALCULATED BY	MCL	DATE	2/10/2020
CHECKED BY		DATE	
SCALE			

28' x 64' MODULAR

SEISMIC per IBC 2018 / ASCE 7-16

ASCE 7-10 Table 1.5-1	Risk Category		II	
ASCE 7-10 Table 1.5-2	Seismic Importance Factor	Ie =	1.00	
ASCE 7-10 Table 12.2-1	Response Modification Factor	R =	6.50	
USGS Data	Spectral Response Accel.	Ss =	1.500	
ASCE 7-10 11.4.2	Site Class D			
ASCE 7-10 Table 11.4-1	Site Coefficient	Fa =	~~1.000~~ 1.2	
ASCE 7-10 Eqn. 11.4-1	Sms = Ss * Fa	Sms =	1.500	
ASCE 7-10 Eqn 11.4-3	Sds = 2/3 * Sms	Sds =	1.000	
		PER ASCE 7-16, 12.8.1.3		
ASCE 7-10 Table 11.6-1	Seismic Design Cat.		D	
ASCE 7-10 Eqn 12.8-1	V = Cs * W = (Sds /(R/Ie) * W)* 0.7	V =	0.108	W
IBC 2015 1605.3.1	Note: 0.7 converts to ASD			
ASCE 7-10 Eqn 12.8-5		Vmin =	0.010	W

Building Weight

	Roof (psf)		Exterior Wall (psf)
Comp	2.5	15/32 T1-11	1.7
7/16 Shtg	1.5	2x6 @ 16	1.7
2x10 @24	1.9	R-21U	1.3
R-30U	1.6	5/8 Gyp	2.8
Drp Grd	1.8		0
	0		0
	0		0
Total	9.3		7.5

	Interior Wall (psf)		Floor (psf)
5/8 Gyp	2.8	Misc	1.0
2x4 @ 16	1.1	23/32 Shtg	2.5
5/8 Gyp	2.8	2x8 @ 16	2.2
	0	R-30U	1.6
	0		0
	0		0
Total	6.7		7.3

MODERN BUILDING SYSTEMS
PO Box 110 • 9493 Porter Rd • Aumsville, OR 97325
800.682.1422 ModernBuildingSystems.com

Building Weight (con't)

No Snow	28.67 '	65.00 '	0.0 psf	=	0	lbs
Roof =	28.67 '	65.00 '	9.3 psf	=	17331	lbs
Ext. Wall =	8.00 '	183.34 '	7.5 psf	=	11000	lbs
Int. Wall =	8.00 '	28.00 '	6.7 psf	=	1501	lbs
Floor =	27.67 '	64.00 '	7.3 psf	=	12927	lbs
Chassis =				=	0	lbs
				=	0	lbs
Total				**W=**	**42760**	lbs

Wr = Total DL tributary to roof 23582 lbs
W1 = Total DL tributary to floor 19178 lbs

Fx Story (Shearwall) Force Table

Story	Height	Weight		Story Force - k Fx= wx*hx/ (∑ wx*hx)*V	Fx Coef = V*hx/(∑ wx*hx)	Story Shear
	(hx)	(wx)	(wx*hx)			(Vx)
R	11.00 '	23.58 k	259 k-ft	**3.89 k**	0.165	3.89 k
1	2.50 '	19.18 k	48 k-ft	**0.72 k**	0.037	4.60 k
Grade	0.00 '					
Sum (∑)		**42.76 k**	**307 k-ft**	**V= 4.60 k**		

Shear Value Comparison	OK

ATC Hazards by Location

L-5 OF L-6

Search Information

Address:	14331 SE 132nd Ave, Clackamas, OR 97015, USA
Coordinates:	45.41883920000001, -122.528807
Elevation:	336 ft
Timestamp:	2020-02-11T19:14:23.061Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D-default

Basic Parameters

Name	Value	Description
S_S	0.841	MCE_R ground motion (period=0.2s)
S_1	0.369	MCE_R ground motion (period=1.0s)
S_{MS}	1.01	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	0.673	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

$\leq 1.000 \therefore$ OK

* See Section 11.4.8

▾Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.884	Coefficient of risk (0.2s)
CR_1	0.865	Coefficient of risk (1.0s)
PGA	0.381	MCE_G peak ground acceleration
F_{PGA}	1.219	Site amplification factor at PGA
PGA_M	0.464	Site modified peak ground acceleration
T_L	16	Long-period transition period (s)
SsRT	0.841	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.952	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.369	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.426	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.532	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

ATC Hazards by Location

L-6 OF L-6

Search Information

Address:	13865 SE King Rd, Happy Valley, OR 97086, USA
Coordinates:	45.4477326, -122.5178081
Elevation:	498 ft
Timestamp:	2020-02-11T19:16:41.622Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D-default

Basic Parameters

Name	Value	Description
S_S	0.866	MCE_R ground motion (period=0.2s)
S_1	0.374	MCE_R ground motion (period=1.0s)
S_{MS}	1.039	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	0.692	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

$\leq 1.000 \therefore$ OK

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.879	Coefficient of risk (0.2s)
CR_1	0.865	Coefficient of risk (1.0s)
PGA	0.394	MCE_G peak ground acceleration
F_{PGA}	1.206	Site amplification factor at PGA
PGA_M	0.476	Site modified peak ground acceleration
T_L	16	Long-period transition period (s)
SsRT	0.866	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.985	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.667	Factored deterministic acceleration value (0.2s)
S1RT	0.374	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.433	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.635	Factored deterministic acceleration value (1.0s)
PGAd	0.686	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

ULTIMATE FRICTION FACTORS AND ADHESION FOR DISSIMILAR MATERIALS (NAVFAC DM 7.2, Table 1, p7.2-63)

Interface Materials	Friction factor	Friction angle, degrees
Mass concrete on the following foundation materials:		
Clean sound rock	0.70	35
Clean gravel, gravel-sand mixtures, coarse sand	0.55 to 0.60	29 to 31
Clean fine to medium sand, silty medium to coarse sand, silty or clayey gravel	0.45 to 0.55	24 to 29
Clean fine sand, silty or clayey fine to medium sand	0.35 to .045	19 to 24
Fine sandy silt, non-plastic silt	0.30 to 0.35	17 to 19
Very stiff and hard residual or pre-consolidated clay	0.40 to 0.50	22 to 26
Medium stiff and stiff clay and silty clay	0.30 to 0.35	17 to 19
(Masonry on foundation materials has same friction factors.)		
Steel sheet piles against the following soils:		
Clean gravel, gravel-sand mixtures, well-graded rock fill with spalls	0.40	22
Clean sand, silty sand-gravel mixture, single size hard rock fill	0.30	17
Silty sand, gravel or sand mixed with silt or clay	0.25	14
Fine sandy silt, non-plastic silt	0.20	11
Formed concrete or concrete sheet piling against the following soils:		
Clean gravel, gravel-sand mixtures, well-graded rock fill with spalls	0.40 to 0.50	22 to 26
Clean sand, silty sand-gravel mixture, single size hard rock fill	0.30 to 0.40	17 to 22
Silty sand, gravel or sand mixed with silt or clay	0.30	17
Fine sandy silt, non-plastic silt	0.25	14
Various structural materials:		
Masonry on masonry, igneous and metamorphic rocks:		
Dressed soft rock on dressed soft rock	0.70	35
Dressed hard rock on dressed soft rock	0.65	33
Dressed hard rock on dressed hard rock	0.55	29
Masonry on wood (cross grain)	0.50	26
Steel on steel at sheet pile interlocks	0.30	17

Interface Materials (Cohesion)	Adhesion C_a (psf)
Very soft cohesive soil (0 - 250 psf)	0 - 250
Soft cohesive soil (250 - 500 psf)	250 - 500
Medium stiff cohesive soil (500 - 1000 psf)	500 - 750
Stiff cohesive soil (1000 - 2000 psf)	750 - 950
Very stiff cohesive soil (2000 - 4000 psf)	950 - 1,300

PGM Inc

TIE DOWNS

ENGINEERED TIE DOWN SYSTEM

GENERAL NOTES

CO

DESIGN LOADS:

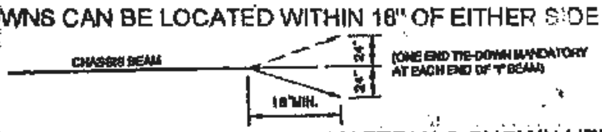
DESIGN LOADS:

- * WIND ———————— 15 PSF (70 MPH EXPOSURE "C") CAC T-25 and COMPLIES WITH 2018 IBC Vult = 115 MPH Exp C
- * SOIL BEARING ——— 1000 PSF
- * TIE DOWN STRAP —— 3150# WORKING LOAD
- * SEISMIC ZONE ———— 4 CAC T-25 AND 2015 IBC Ss=1.5 Fa=1.4 Sds1.41 Site Class D

TIE DOWN STRAPS TO BE MIN. 1 1/4" WIDE x 0.035 THICKNESS ZINC PLATED AND MEET ASTM D-3953-97 ALT. STRAP; 1 1/4" WIDE X 0.029" THICK ZINC PLATED F'ult' =5400 LBS

- * EARTH AUGERS ———————— 2982 # (TESTED TO 4750# MIN.)
- * CROSS DRIVES ———————— 2982 # (TESTED TO 4750# MIN.)
- * CONCRETE SLAB ANCHORS ——— 2982 # (CALCULATED)

1. THE CHARTS SHOW THE REQUIRED NUMBER OF TIE DOWNS ON THE SIDES AND ENDS OF THE MANUFACTURED HOME.
2. COMBINATIONS OF THE DIFFERENT TYPES OF TIE DOWNS CAN BE USED.
3. FOR ALL TIE DOWN INSTALLATIONS, THE MANUFACTURED HOME CHASSIS MEMBERS ARE SHOWN AS "I" BEAMS, (FOR ILLUSTRATION PURPOSE ONLY) CHASSIS BEAMS
4. SIDE TIE DOWNS ARE REQUIRED ALONG THE OUTSIDE CHASSIS BEAMS. END TIE DOWNS ARE REQUIRED AT EACH END OF EACH TRANSPORTABLE SECTION OF THE MANUFACTURED HOME.
5. END TIE DOWNS CAN BE LOCATED WITHIN 18" OF EITHER SIDE OF CHASSIS BEAM



6. THE SIZES, TYPES, LENGTHS, ECT, OF MATERIALS SHOWN HEREON ARE MINIMUM, LARGER, LONGER, HEAVIER MATERIALS SUPPLIED BY SAC INDUSTRIES, INC. MAY BE USED AT THE SAME SPACING AND LOCATION SHOWN.
7. ALL PARTS ARE COATED WITH RUST RESISTANT INDUSTRIAL SHOP PRIMER

PGM Inc
21822 Old Hwy 99
Centralia, WA 98532
888-265-8981

STATE APPROVAL

CA

PACIFIC CONSULTING ENGINEERS
9739 North Vista Drive
Kingman, AZ 86401
PH 916-296-7376

ENGINEERS APPROVAL

OR

REGISTERED PROFESSIONAL ENGINEER 7462 OREGON JULY 14, 1972 DAVID A. DAHMER

EXP 12/31/21

WA

DAVID A. DAHMER STATE OF WASHINGTON 14176 REGISTERED PROFESSIONAL ENGINEER

EXP 7-17-21

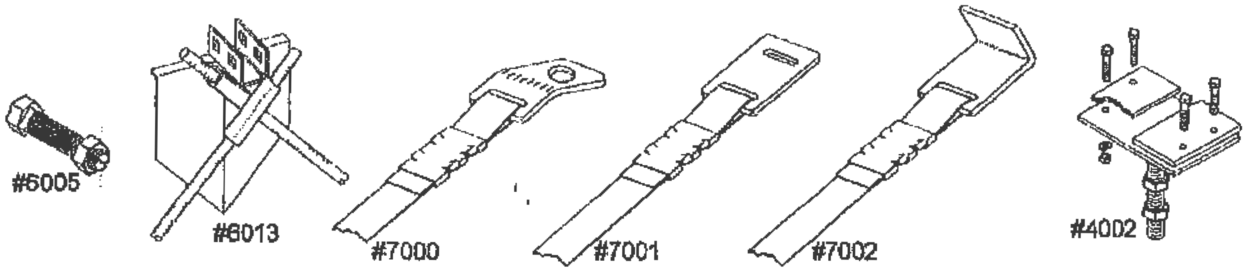
ID

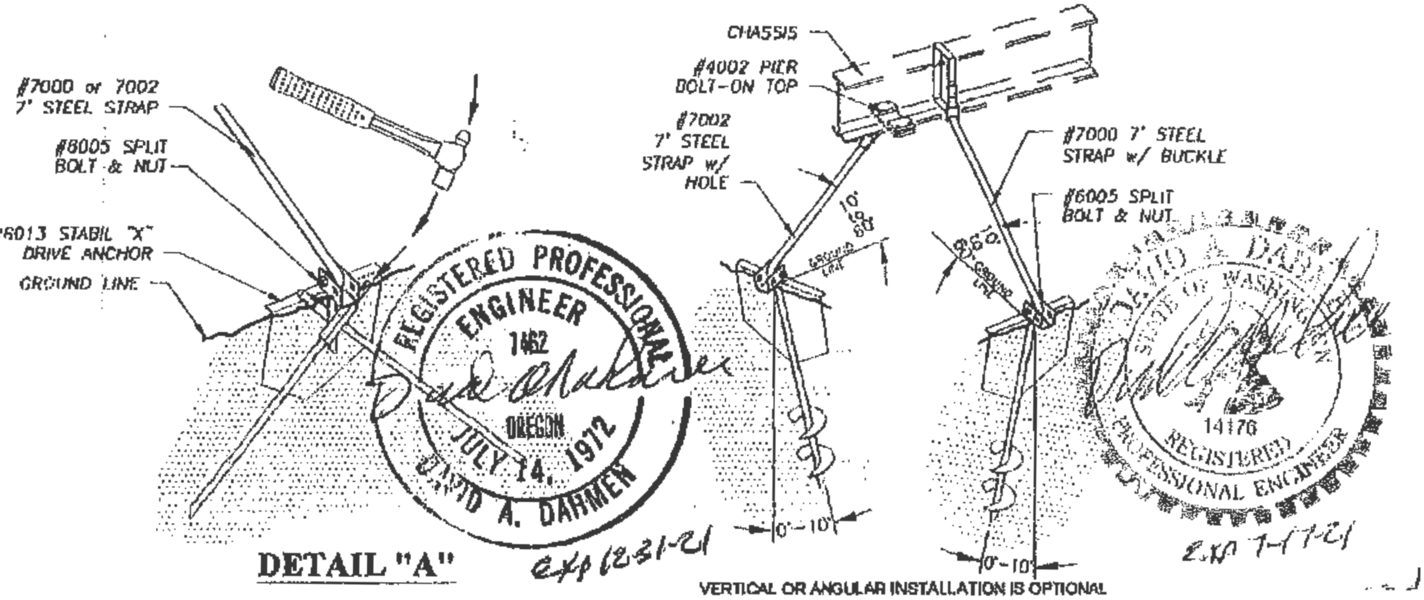
UT

AZ

NV

SAC IND. STABIL-X DRIVE TIE DOWN ANCHORS



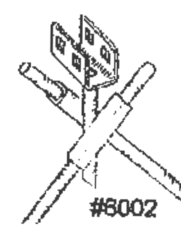


DETAIL "A"

STABIL-X DRIVE TIE DOWN
SEE DETAIL "A"

INSTALLATION INSTRUCTIONS

1. <u>CONTRACTORS WARNING:</u> CHECK FIRST FOR UNDERGROUND UTILITIES.
2. DRIVE STABILIZER PLATE INTO GROUND.
3. DRIVE CROSS RODS THROUGH HEAD TUBES INTO SOIL AS SHOWN.
4. ATTACH STRAPS TO CHASSIS BEAM IN MANNER SHOWN.
5. IF ANGLE OF SIDE STRAP IS GREATER THEN 60°, STRAP CONNECTION CAN BE MADE FROM ANCHOR TO OPPOSITE CHASSIS BEAM.
6. INSERT STRAP THROUGH SPLIT BOLT. CUT OFF EXCESS STRAP AND TIGHTEN BOLT UNTIL STRAP IS SNUG.
7. #6002 ANCHOR CAN BE USED WHERE HARD OR ROCKY SOIL OCCURS. IF THE GROUND SURFACE IS OTHER THAN ROCKY SOIL OR MINIMUM 2" ASPHALT, USE STABIL-X ANCHOR OR ENCASE ANCHOR WITH 12'x12"x12" CUBE OF CONCRETE.
8. WHEN #6002 ANCHOR IS USED FOR ANY REQUIRED ANCHOR -- (2) ANCHORS MUST BE USED AT THAT LOCATION.



SEE NOTE #7
AND NOTE #8

EARTH AUGERS						CROSS DRIVE ANCHORS						CONCRETE SLAB ANCHORS					
MAX. LENGTH OF MFG'D HOME	36'	54'	72'			MAX. LENGTH OF MFG'D HOME	36'	54'	72'			MAX. LENGTH OF MFG'D HOME	36'	54'	72'		
MIN. NO. OF SIDE TIE DOWNS	2	3	4			MIN. NO. OF SIDE TIE DOWNS	2	3	4			MIN. NO. OF SIDE TIE DOWNS	2	3	4		

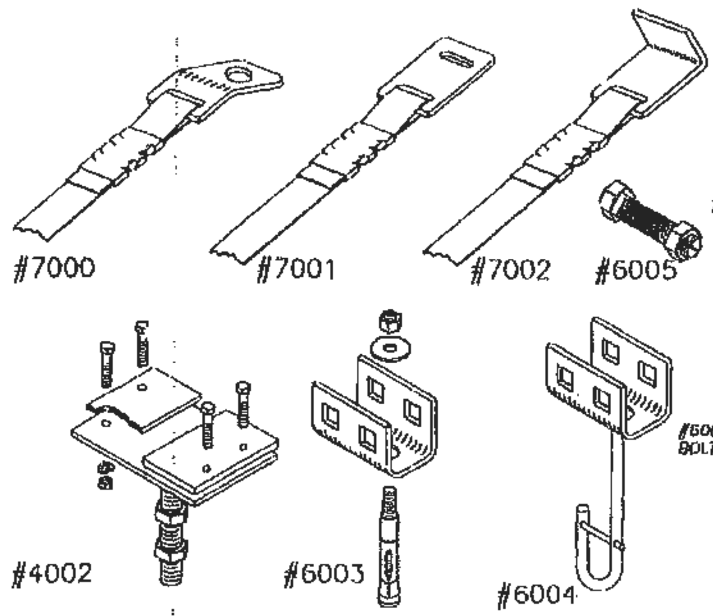
NOTE:

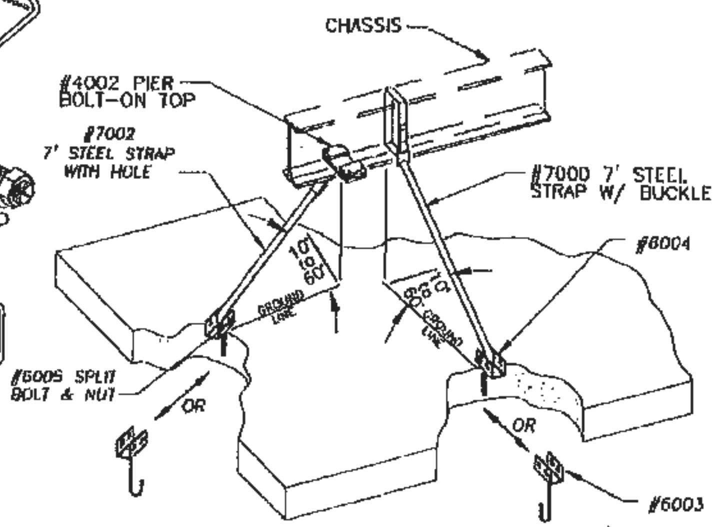
SIDE TIE-DOWNS: MUST BE WITHIN 24" OF THE END OF THE CHASSIS BEAM.

END TIE-DOWNS: CAN BE LOCATED WITHIN 24" OF EITHER SIDE OF CHASSIS BEAM ONE TIE-DOWN IS MANDATORY AT EACH END OF "I"BEAM (SEE PAGE #1 GENERAL NOTE #5).

IF SIDE WALL TIE-DOWN GROUND ANCHOR LOCATION IS SUCH THAT THE ANGLE BETWEEN THE GROUND AND STRAP EXCEEDS 60°, CONNECT THE TIE STRAP TO THE INSIDE CHASSIS BEAM ON DOUBLE AND TRIPLE WIDES AND THE OPPOSITE CHASSIS BEAM ON SINGLE WIDES.

SAC IND. CONCRETE TIE DOWN ANCHORS





CONCRETE TIE-DOWN

ALTERNATE CONNECTION

INSTALLATION INSTRUCTIONS

NEW CONCRETE - #6004

1. PLACE CONCRETE ANCHOR INTO WET CONCRETE, AND ALLOW TO PROPERLY CURE.
2. ALTERNATE CONNECTION REQUIRES #5 REBAR PROPERLY EMBEDDED IN CONCRETE.

EXSISTING CONCRETE - #6003

1. CONCRETE MUST BE A MINIMUM 3½" THICK AND IN GOOD CONDITION.
2. MINIMUM SLAB AREA OF EACH ANCHOR IS 28 SQUARE FEET.
3. DRILL PROPER SIZE HOLE IN SLAB, A MINIMUM OF 12" FROM ANY SIDE.
4. EXPANSION BOLT IS ⅝" x 3½" WITH MINIMUM 2¾" EMBEDMENT AND 6,160 POUNDS PULL OUT, 7,160 POUNDS SHEAR.

CHASSIS CONNECTION

1. ATTACH STRAPS TO CHASSIS BEAM IN MANNER SHOWN.
2. IF ANGLE OF SIDE STRAP IS GREATER THAN 60°, STRAP CONNECTION CAN BE MADE FROM ANCHOR TO OPPOSITE CHASSIS BEAM.
3. INSERT STRAP THROUGH SPLIT BOLT, CUT OFF EXCESS STRAP AND TIGHTEN BOLT UNTIL STRAP IS SNUG.

NOTE: SIDE TIE DOWNS ARE REQUIRED ALONG THE OUTSIDE CHASSIS BEAMS. END TIE DOWNS ARE REQUIRED AT EACH END OF EACH TRANSPORTABLE SECTION OF THE MANUFACTURED HOME.

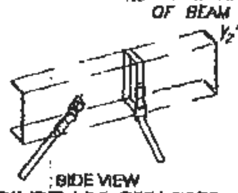
NOTE: A COMBINATION OF DIFFERENT TYPES OF TIE DOWNS CAN BE USED.

DAVID A. DAHMEN
STATE OF WASHINGTON
14176
REGISTERED PROFESSIONAL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 14, 1972
DAVID A. DAHMEN

EXP 12/31/21

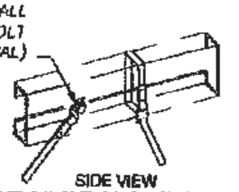
DRILL 9/16" HOLE AT MID HEIGHT OF BEAM AND INSTALL ½" A307 BOLT (TYPICAL)



SIDE VIEW

"C" BEAM CHASSIS

SEE GENERAL NOTE #3



SIDE VIEW

"RFC" BEAM CHASSIS

SEE GENERAL NOTE #3

SIDE VIEW   END VIEW

END TIE DOWN

NOTE: END TIE DOWN CAN BE LOCATED WITHIN 18" OF EITHER SIDE OF CHASSI BEAM AXIS.

CONTRACTORS CERTIFICATION

I CERTIFY THAT I HAVE INSTALLED THE SAC IND., INC. ANCHORING SYSTEM AS PER THE INSTALLATION INSTRUCTIONS. I HAVE MADE NO MODIFICATIONS TO THE ANCHORING SYSTEM OR THE BUILDING STRUCTURE.

COMPANY NAME: ______________________ CONTRACTORS LIC. # ______________

PGM Inc.

Soil Class	Soil Description	Test Probe Values (in lbs.)	Recommended PGM Part	PGM part description
1	Hard Rock or Rocky	N/A	# 6011 or # 6002	Cross Drive Anchor W/ 30" Rods Cross Drive Anchor W/ 30" Rods
2	Very Dense and or Cemented Sands, Coarse Gravel, Cobbles and Clays	550+	# 6000 # 6006 # 6013	30" Auger Anchor W/2 4" Helix 12" Stabilizer Plate Stabil X - Drive
3	Medium Dense Coarse Sands, Sandy Gravels, Very Very Stiff Silts & Clays	351 to 550	Available Upon Request	
4a	Loose to Medium Dense Sands, Firm to Stiff Clays & Silts, Alluvial Fill	276 to 350	Available Upon Request	
4b	Very Loose Sands, Firm Clays & Silts Alluvial Fill	175 to 275	Available Upon Request	

Please Note : Each State, County or Municipality may require a specific anchor from the groups shown above for each soil classification.

Check local and stata regulations first.

PGM Inc

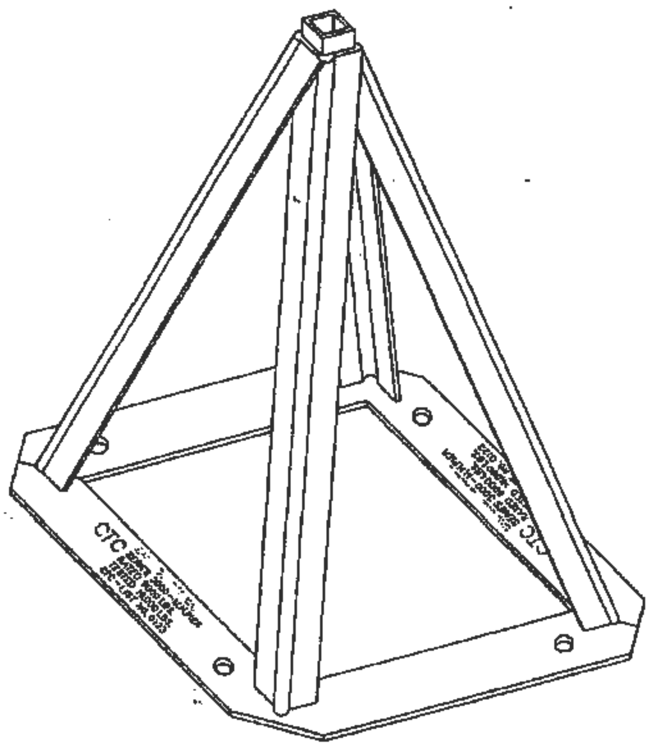
STEEL PIERS

ADJUSTABLE STEEL PIERS & TOPS

GENERAL NOTES

DESIGN LOADS:

* STEEL PIERS ------------ 6,000 LB. RATED LOAD CAPACITY
  18,000 LB. MINIMUM TESTED LOAD CAPACITY
* STEEL PIERS SHALL BE COATED WITH RUST RESISTANT COATING AND SHALL BE LISTED AND LABELED FOR THE FOLLOWING LOAD:
  VERTICAL=6,000 POUNDS MAXIMUM



STATE APPROVAL

PGM Inc
21822 Old Hwy 99
Centralia, WA 98532
888-265-8981

PACIFIC CONSULTING ENGINEERS
9739 North Vista Drive
Kingman, AZ 86401
PH 916-296-7376

ENGINEER APPROVAL

CA

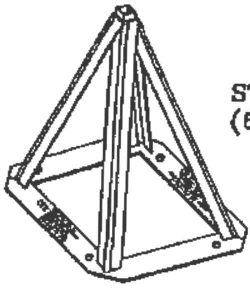
REGISTERED PROFESSIONAL ENGINEER
7463
OREGON
JULY 14, 1972
DAVID A. DAHMEN
EXP 12-31-21

DAVID A. DAHMEN
STATE OF WASHINGTON
14176
REGISTERED PROFESSIONAL ENGINEER
EXP 7-17-21

PGM Inc SYSTEM SET

(TYPICAL)

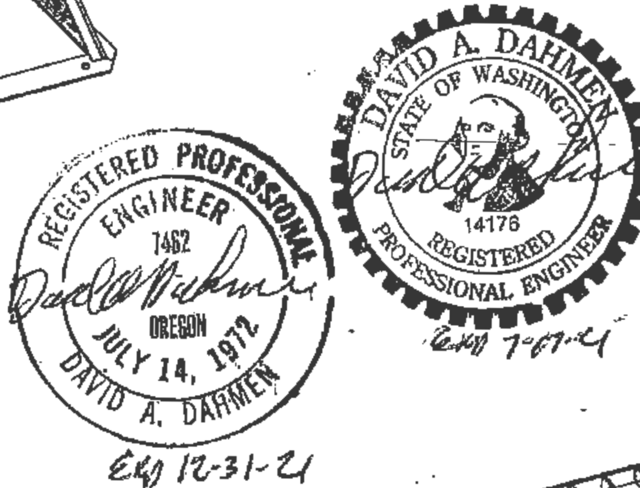
BOLT-ON TOP

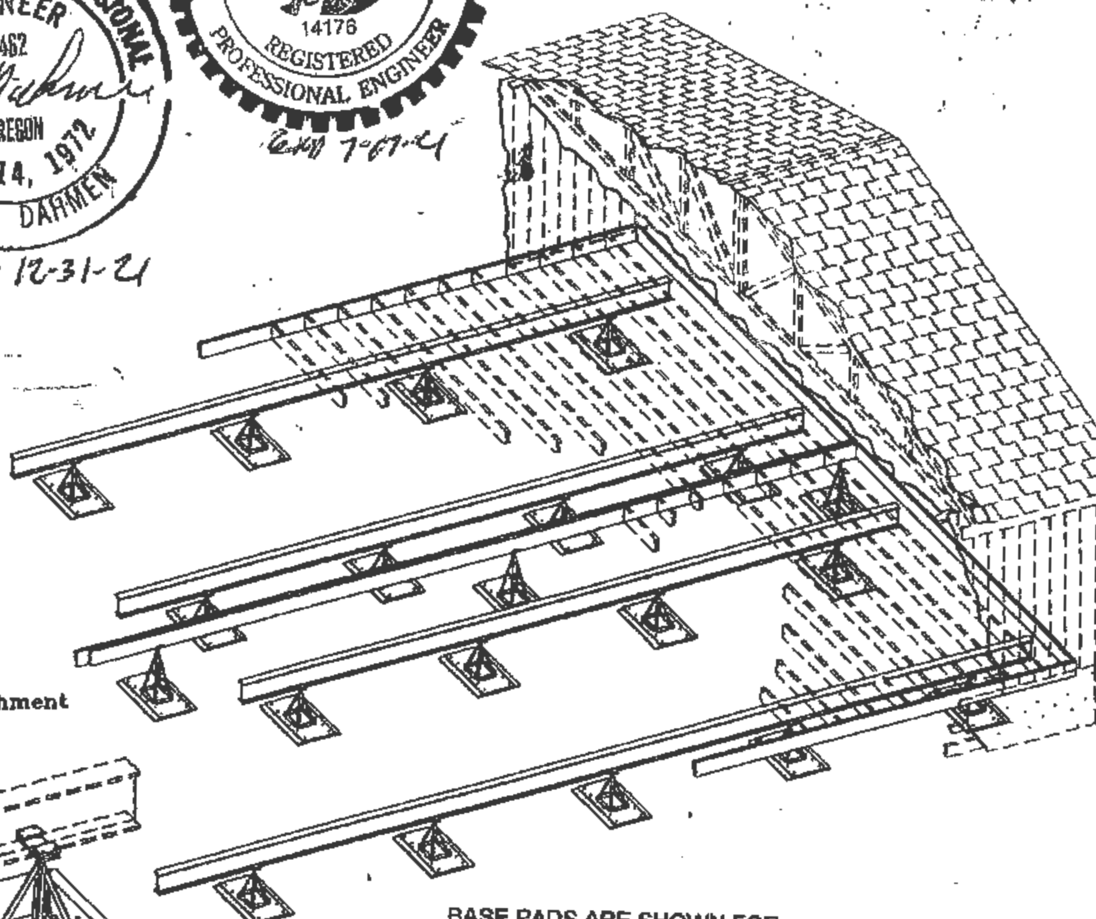


STEEL PIER
(6,000 LB RATED)

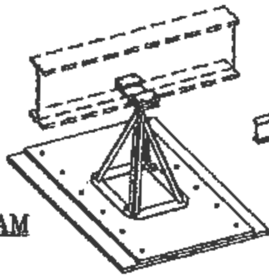
NOTES

CHECK MANUFACTURED HOME SET UP INSTRUCTIONS FOR LOADS AND LOCATIONS.



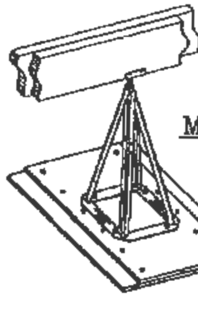


- **STATE APPROVED**
  Tested-Listed-Labeled
  Stamped in Base Plate
- **6,000 LB. RATED**
  3-1 Safety Factor
- **HOLES PRE-PUNCHED**
  In base for easy attachment
  to pad or footing

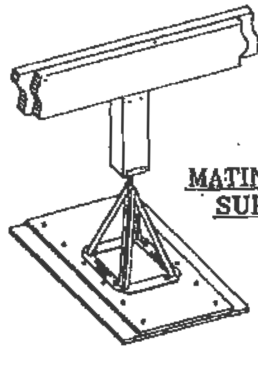


CHASSIS BEAM
SUPPORT

BASE PADS ARE SHOWN FOR
ILLUSTRATION ONLY AND ARE
NOT A PART OF THE PIER APPROVAL

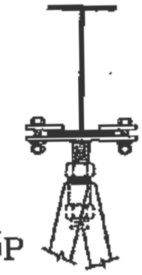


MATING LINE
SUPPORT



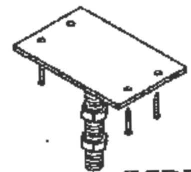
MATING LINE
SUPPORT

ADJUSTABLE STEEL TOPS

REGISTERED PROFESSIONAL ENGINEER
7462
OREGON
JULY 14, 1972
DAVID A. DAHMEN
EXP 12-31-21

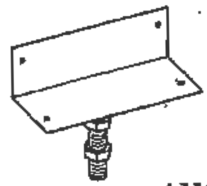
BOLT ON TOP
#4002




SCREW ON TOP
#4006

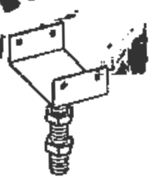

DAVID A. DAHMEN
STATE OF WASHINGTON
14176
REGISTERED PROFESSIONAL ENGINEER

"L" TOP
#4003

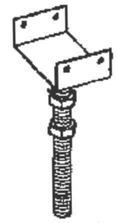



ANGLE TOP
#4005

EXP 1-07-21




5" SADDLE TOP
#4000




11" SADDLE TOP
#4001

INSTALLATION INSTRUCTIONS

#4000 – PLACE SADDLE TOP FLUSH AGAINST MAIN CHASSIS BEAM AND OR MATING LINE – MAXIMUM HEIGHT ADJUSTMENT OF TOP IS 2".

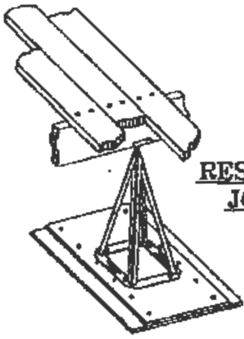
#4001 – 11" SADDLE CAN TO BE USED ON MATING LINE SUPPORTS, PORCHES AND DECKS – ATTACH TOP OF PIER WITH 2nd 3/4" NUT – MAXIMUM HEIGHT ADJUSTMENT OF TOP IS 6".

#4002 – ATTACH BOLT ON TOP TO "I" BEAM WITH (4) 3/8" BOLTS AND NUTS – WITH 2nd 3/4" NUT, ATTACH BOLT ON TOP TO PIER – MAXIMUM HEIGHT ADJUSTMENT OF TOP IS 2".

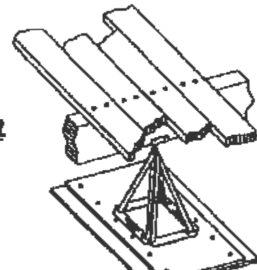
#4003 – PLACE "L" TOP FLUSH AGAINST MAIN BEAM – ALTERNATE "L" TOP DIRECTION EVERY OTHER PIER – MAXIMUM HEIGHT ADJUSTMENT OF TOP IS 2".

#4005 – PLACE ANGLE TOP FLUSH AGAINST MAIN BEAM ("C"BEAM or "RFC"BEAM) – MAXIMUM HEIGHT ADJUSTMENT OF TOP IS 2".

#4006 – ATTACH SCREW ON TOP TO MAIN CHASSIS BEAM WITH (4) #12 SMS TEK SCREWS. WHEN USED AT MATING LINE AND OR PERIMETER, ATTACH WITH NAILS OR SCREWS. MAXIMUM HEIGHT ADJUSTMENT OF TOP IS 2".



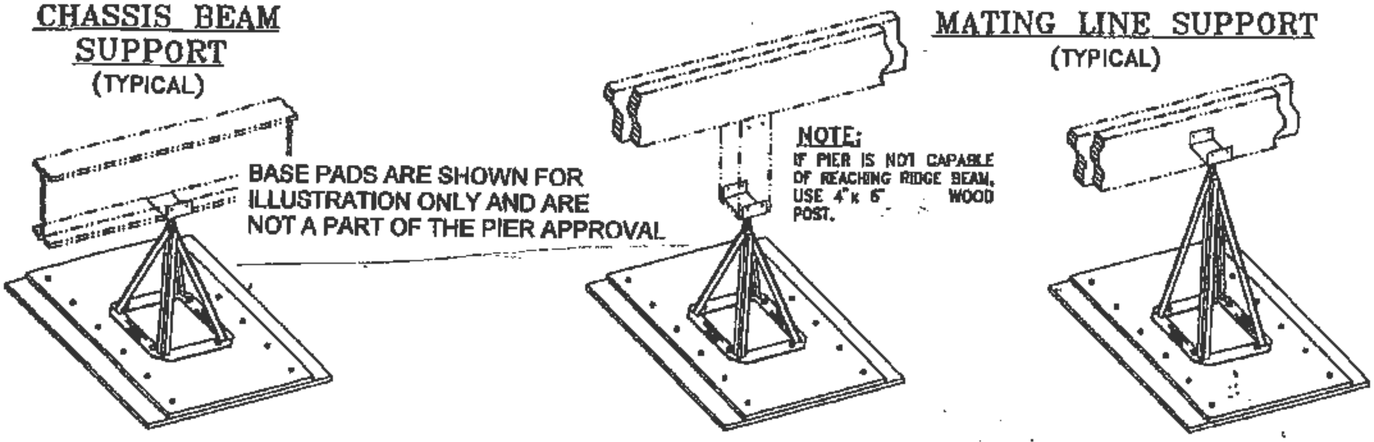
RESIDENTIAL FLOOR JOINT SUPPORT



DECK SUPPORT

BASE PADS ARE SHOWN FOR ILLUSTRATION ONLY AND ARE NOT A PART OF THE PIER APPROVAL

ADJUSTABLE STEEL PIERS



INSTALLATION INSTRUCTIONS

1. PREPARE A LEVEL SURFACE AT THE LOCATION OF EACH PIER TO INSURE A FULL CONTACT FOR THE FOOTING PAD. USE THE APPROPRIATE SIZE PAD FOR THE LOAD REQUIRED. REFER TO THE MANUFACTURERS SET UP MANUAL FOR SPECIFIC LOADS AND FOOTING SIZES.

2. SELECT THE APPROPRIATE SIZE PIERS FOR THE INSTALLATION BY DETERMINING THE PIER HEIGHT AT EACH SUPPORT LOCATION. MEASURE FROM THE TOP OF THE PAD TO THE BOTTOM OF THE CHASSIS BEAM TO INSURE THAT HEIGHT IS NO GREATER THAN 32".

3. SELECT THE APPROPRIATE TOP FOR THE CHASSIS BEAM OR MATING LINE. THE MAXIMUM ADJUSTMENT ON THE THREADED ROD ADJUSTER FOR CHASSIS BEAM SUPPORT IS 2". WHEN MORE HEIGHT IS NEEDED USE THE NEXT TALLER SIZE SUPPORT PIER.

4. PLACE THE PIER SUPPORT IN THE CENTER OF THE SUPPORT PAD. WHERE REQUIRED BY LOCAL CODE, ATTATCH THE SUPPORT PIER TO THE PAD USING APPROPRIATE FASTENERS. CAREFULLY ALIGN THE SUPPORT PIER AND TOP UNDER THE CHASSIS BEAM OR MATING LINE AND TIGHTEN UNTIL SNUG PLUS 1/2 TURN.

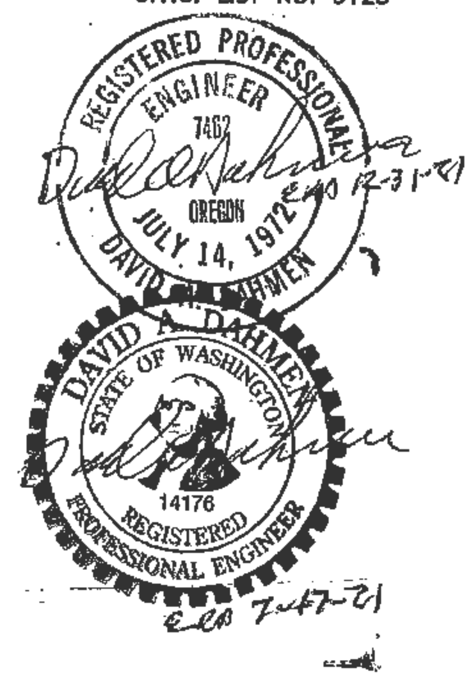
5. REPEAT THIS INSTALLATION PROCEDURE WITH EACH SUPPORT PIER. AFTER ALL THE SUPPORT PIERS HAVE BEEN INSTALLED, AND THE HOME SET UP HAS BEEN COMPLETED PER THE MANUFACTURERS SET UP INSTRUCTIONS, YOU MAY THEN REMOVE THE SAFTEY BLOCKING OF OTHER DEVICES USED TO LEVEL THE CHASSIS.

LABORATORY TESTING REPORT

PART No.	STAND SIZE	SAMPLE #1	SAMPLE #2	SAMPLE #3
3008	8"	23,100 Lbs.	24,600 Lbs.	23,200 Lbs.
3010	10"	25,130 Lbs.	25,950 Lbs.	24,320 Lbs.
3012	12"	27,200 Lbs.	26,500 Lbs.	26,300 Lbs.
3014	14"	27,700 Lbs.	28,175 Lbs.	26,175 Lbs.
3016	16"	28,250 Lbs.	27,700 Lbs.	23,400 Lbs.
3018	18"	26,400 Lbs.	33,300 Lbs.	25,500 Lbs.
3020	20"	24,950 Lbs.	25,000 Lbs.	23,225 Lbs.
3022	22"	20,500 Lbs.	22,400 Lbs.	24,200 Lbs.
3024	24"	22,225 Lbs.	21,650 Lbs.	23,000 Lbs.
3026	26"	22,250 Lbs.	21,500 Lbs.	19,700 Lbs.
3028	28"	20,550 Lbs.	23,720 Lbs.	21,310 Lbs.
3030	30'	22,950 Lbs.	26,550 Lbs.	21,500 Lbs.
3032	32"	21,200	22,000	21,900
3034	34'	20,900	21,200	21,000
3036	36"	20,500	19,900	19,800

PIER IDENTIFICATION STAMP

PGM Inc-Centralia, WA
SERIES 3000-M H PIER
RATED 6,000 LBS.
TESTED 18,000 LBS
C.T.C. LIST NO. 0123



Commercial Application Checklist

Clackamas County Building Codes
150 Beavercreek Road, Oregon City, OR 97045
(503) 742-4240, Fax: (503) 742-4741
www.clackamas.us/building

PROJECT INFORMATION

Project name: Clackamas High School East, Temporary Modular Classrooms			Date: 2/20/2020
Project address: 14331 SE 132ND Ave	City: Clackamas	State: OR	ZIP: 97015
Scope of work: Addition of (2) modular buildings, each containing (2) classrooms. Scope includes associated decking, grading and irrigation modifications, site paving, utility routing and stormwater routing.			
Reference no.:	Map and tax-lot no.: 22E02CD01200		
Contact person name: Brian Squillace	Company: Bora Architects		
Phone: 503.226.1575	Fax: N/A		
Cellular phone: N/A	E-mail: squillace@bora.co		

NOTES AND INSTRUCTIONS

- The purpose of this checklist is to help define a complete submittal package for the scope of work. Plan review will not take place until a complete package is submitted.
- This checklist can be used for all commercial construction projects, including new construction, additions, alterations and tenant improvements.
- For complex projects, applicants should use the “location” space to note the item’s location and page number from the plans or the specification book.
- It is not necessary to duplicate submittal information, even if it is asked for in multiple sections.
- In the checklist, “Required” means that the applicant must provide this information for plan review.
- In the checklist, “P” means —
  - *if checked by the applicant* — the information is provided for the plan review.
  - *if checked by the plans reviewer* — this information is required for the plan review.
- In the checklist, “NA” means that the information does not apply.
- Choose only those sections of the checklist that apply to your scope of work. Section 1.0, “General Project Data,” must be included with each project submitted.

PRE-SUBMITTAL PROCESS

An applicant may request a pre-submittal meeting with representatives of the jurisdiction in which the project will be built. The meeting may take place during the conceptual, schematic, or in-progress phase, or when the applicant has completed plans.

INDEX OF CHECKLIST SECTIONS

SECTION 1.0 — GENERAL PROJECT DATA

Construction documents — *Location (sheet number or spec section)*

1.1	X	Required	No. of sets of plans: ________	submitted digitally
1.2	X	Required	Cover sheet title block	G101
1.3	X	Required	Cover sheet vicinity map	G101
1.4	X	Required	Cover sheet plan index	G101
1.5	X P	NA	Code summary	G101
1.6	P	X NA	Deferred submittal summary	
1.7	X P	NA	Professional stamp and signature	all drawing sheets
1.8	P	X NA	Fire-and-life-safety plan	
1.9	P	X NA	Landscape plan	
1.10	P	X NA	Landscape specifications	

Supporting documents — *Notes*

1.20	P	X NA	Land-use or planning actions	
1.21	P	X NA	Required fire-flow calculations	
1.22	P	X NA	Fire-hydrant flow-test report	
1.23	P	X NA	Fire department or fire district building survey report	
1.24	P	X NA	Material safety data sheets (MSDS)	

SECTION 2.0 — CIVIL DATA

Construction documents — *Location (sheet number or spec section)*

2.1	X	Required	Site plan	C111
2.2	X	Required	Site utility plan	C131
2.3	X	Required	Grading plan	C111
2.4	X	Required	Erosion-control plan	C121
2.5	P	X NA	Utility-vault location and details	

Supporting documents — *Notes*

2.20	P	X NA	Geotechnical/soil engineer report	
2.21	X P	NA	Storm-water calculations	
2.22	P	X NA	Site retaining-wall structural calculations	
2.23	P	X NA	“Assurance of Compliance” with environmental rules	

SECTION 3.0 — ARCHITECTURAL DATA

Construction documents				*Location (sheet number or spec section)*
3.1	X	Required	Floor plan(s)	A111
3.2	X	Required	Transverse and longitudinal cross sections	see package by Modular Building Systems
3.3	X	Required	OSSC Chapter 11 accessibility requirements	G101
3.4	X P	NA	Interior elevations	A111
3.5	P	X NA	Exterior elevations	
3.6	P	X NA	Roof plan	
3.7	P	X NA	Wall type sections and details	
3.8	P	X NA	Reflected ceiling plan(s)	
3.9	P	X NA	Fire-rated construction details	
3.10	P	X NA	Energy-code-compliant construction details and specifications	
3.11	P	X NA	Door schedule	
3.12	P	X NA	Glazing schedule	
3.13	P	X NA	Furniture plan	

Supporting documents				*Notes*
3.20	P	X NA	Energy-code-compliance forms/calculations	
3.21	P	X NA	Material safety data sheets (MSDS)	
3.22	P	X NA	Hazardous materials inventory statement (HMIS)	
3.23	P	X NA	Hazardous materials management plan (HMMP)	
3.24	P	X NA	Written fire-and-life-safety evacuation plan for area of rescue assistance	
3.25	P	X NA	Active and passive smoke-control information	

SECTION 4.0 — STRUCTURAL DATA

Construction documents — *Location (sheet number or spec section)*

					Location
4.1	X	Required		Structural cover sheet	see package by Modular Building Systems
4.2	X	P	NA	Foundation plan and details	see package by Modular Building Systems
4.3		P	X NA	Under-slab mechanical plan	
4.4		P	X NA	Under-slab electrical plan	
4.5		P	X NA	Under-slab plumbing plan	
4.6	X	P	NA	Floor framing plan	see package by Modular Building Systems
4.7	X	P	NA	Roof framing plan	see package by Modular Building Systems
4.8		P	X NA	Structural elevations	
4.9	X	P	NA	Structural details and cross sections	see package by Modular Building Systems
4.10		P	X NA	Standpipe information	
4.11		P	X NA	Special inspector/structural observation matrix	

Supporting documents — *Notes*

					Notes
4.20		P	X NA	Geotechnical/soil engineer report	
4.21		P	X NA	Site-specific seismic hazard report	
4.22		P	X NA	Design narrative	
4.23	X	P	NA	Structural calculations	see package by Modular Building Systems

SECTION 5.0 — MECHANICAL DATA (New construction, tenant improvement, gas piping permits)

NOT IN SCOPE

Construction documents				*Location (sheet number or spec section)*
5.1	Required		Floor plan	
5.2	Required		Equipment schedule	
5.3	P	NA	Site plan	
5.4	P	NA	Under-slab mechanical plan	
5.5	P	NA	Roof plan	
5.6	P	NA	Fuel-gas-piping plan	
5.7	P	NA	HVAC equipment and duct plan(s)	
5.8	P	NA	Roof access details	
5.9	P	NA	Duct smoke-detector plans	
5.10	P	NA	Fire/smoke damper locations	
5.11	P	NA	Smoke-control plan	
5.12	P	NA	Outside air (OSA) table	
5.13	P	NA	Refrigeration equipment and piping plan	
5.14	P	NA	Kitchen equipment plan	
5.15	P	NA	Type I and/or Type II (see Section 7.0 — M	
5.16	P	NA	Fume/vapor hood plan	
5.17	P	NA	Process piping/produc duct plan	
5.18	P	NA	Fire-rated construction details	
5.19	P	NA	Equipment hanger/fastener details	

Supporting documents				*Notes*
5.20	Required		Structural calculations for vertical loads	
5.21	Required		Structural calculations for lateral loads, for equipment weighing over 400 lbs.	
5.22	P	NA	Equipment manufacturers' catalog "cut sheets" or specifications	
5.23	P	NA	Outside air (OSA) calculations	
5.24	P	NA	Smoke-control calculations	
5.25	P	NA	Combustion-air calculations	
5.26	P	NA	Fuel-gas-piping sizing calculations	
5.27	P	NA	Make-up air calculations	
5.28	P	NA	Energy-code-compliance forms	
5.29	P	NA	Boiler information	

NOT IN SCOPE

SECTION 6.0 — MECHANICAL DATA (Additional or replacement rooftop installation permits)

Construction documents				*Location (sheet number or spec section)*
6.1	Required		Roof plan	
6.2	P	NA	Roof framing plan	
6.3	P	NA	Fuel gas-piping plan	
6.4	P	NA	Roof access details	

Supporting documents				*Notes*
6.20	Required		Structural calculations for vertical loads	
6.21	Required		Structural calculations for lateral loads, for equipment weighing over 400 lbs.	
6.22	P	NA	Equipment manufacturers' catalog "cut sheets" or specifications	
6.23	P	NA	Fuel gas piping sizing calculations	
6.24	P	NA	Energy-code-compliance forms	

SECTION 7.0 — MECHANICAL DATA (Type I and Type II kitchen hood permits)

Construction documents				*Location (sheet number or spec section)*
7.1	Required		Site plan	
7.2	Required		Floor plan(s)	
7.3	Required		Kitchen equipmen	
7.4	Required		Kitchen equipment and hood elevations	
7.5	P	NA	Roof plan	
7.6	P	NA	Cross sections through hoods, ducts and shafts	
7.7	P	NA	Fire-rated construction details	
7.8	P	NA	Fire suppression details	

Supporting documents				*Notes*
7.20	Required		Structural calculations for vertical loads	
7.21	Required		Structural calculations for lateral loads, for equipment weighing over 400 lbs.	
7.22	Required		Make-up air calculations	
7.23	P	NA	Equipment manufacturers' catalog "cut sheets" or specifications	
7.24	P	NA	Hood/grease extractor listing documentation	
7.25	P	NA	Hood/grease duct sizing calculations	
7.26	P	NA	Fire suppression information	

SECTION 8.0 — PLUMBING DATA

NOT IN SCOPE

Construction documents *Location (sheet number or spec section)*

8.1	Required		Floor plan(s)	
8.2	Required		Piping and material schedule	
8.3	Required		Equipment layout plan	
8.4	Required		Fixture schedule	
8.5	P	NA	Site utility plan	
8.6	P	NA	Building cross section	
8.7	P	NA	Rise diagram	
8.8	P	NA	Roof plan	
8.9	P	NA	Backflow-prevention l	
8.10	P	NA	Irrigation plan	
8.11	P	NA	Fire-rated construction	
8.12	P	NA	Under-slab plumbing p	

Supporting documents

8.20	Required		Structural calculations for vertical loads	
8.21	Required		Structural calculations for lateral loads, for equipment weighing over 400 lbs.	
8.22	P	NA	Equipment manufacturers' catalog "cut sheets" or specifications	
8.23	P	NA	Utility maintenance agreements	
8.24	P	NA	Water supply calculations	
8.25	P	NA	Sanitary system calculations	
8.26	P	NA	Irrigation demand calculations	
8.27	P	NA	Roof drain and storm-water calculations	

SECTION 9.0 — ELECTRICAL DATA

Construction documents *Location (sheet number or spec section)*

9.1	X Required		No. of sets of plans: ________	submitted digitally
9.2	X Required		Floor plan(s)	E121
9.3	X Required		Electrical load calculations	E151
9.4	X Required		One line diagram	E151
9.5	X Required		Feeder riser diagram	E151
9.6	X Required		Available fault current information	E151
9.7	X Required		Panel schedule(s)	E151
9.8	X P	NA	Site electrical plan	E111
9.9	P	X NA	Fire-rated-construction details	
9.10	P	X NA	Lighting plan	
9.11	P	X NA	Emergency power system and emergency lighting plan	
9.12	P	X NA	Under-slab electrical plan	

Supporting documents *Notes*

9.20	Required		Structural calculations for vertical loads	N/A
9.21	Required		Structural calculations for lateral loads, for equipment weighing over 400 lbs.	N/A
9.22	P	X NA	Energy code compliance forms and calculations for lighting	
9.23	P	X NA	Emergency power system specifications	
9.24	P	X NA	Feeder riser information	
9.25	P	X NA	Lighting equipment manufacturers' catalog "cut sheets" or specifications	

SECTION 10.0 — FIRE SUPPRESSION DATA

NOT IN SCOPE

Construction documents				Location (sheet number or spec section)
10.1	Required		Floor plan(s)	
10.2	X Required		Sprinkler piping plan(s)	
10.3	P	NA	Site plan	
10.4	P	NA	Standpipe information	
10.5	P	NA	Backflow-prevention information	
10.6	P	NA	Reflected ceiling plar	
10.7	P	NA	Transverse and longit	
10.8	P	NA	Fire-rated constructio	
10.9	P	NA	Specialty fire suppres and list of systems	

Supporting documents				Notes
10.20	Required		Structural calculations for vertical loads	
10.21	Required		Structural calculations for lateral loads, for equipment weighing over 400 lbs.	
10.22	Required		Equipment manufacturers' catalog "cut sheets"	
10.23		NA	Hydraulic calculations	
10.24	P	NA	Specialty fire-suppression-system information	

SECTION 11.0 — FIRE DETECTION AND ALARM DATA

Construction documents					Location (sheet number or spec section)
11.1	X	Required		Floor plan(s)	E121
11.2	X	P	NA	Site plan	E111
11.3		P	X NA	Reflected ceiling plan(s)	
11.4		P	X NA	Transverse and longitudinal cross section(s)	
11.5		P	X NA	Wiring schematic	
11.6		P	X NA	Elevator recall information	
11.7		P	X NA	Operational matrix	
11.8		P	X NA	Fire-rated construction details	
11.9	X	P	NA	Standard electrical notes	E101 & E181

Supporting documents				Notes
11.20	Required		Structural calculations for vertical loads	N/A
11.21	Required		Structural calculations for lateral loads. Calculations for lateral loads for equipment weighing over 400 lbs.	N/A
11.22	Required		Equipment manufacturers' catalog "cut sheets"	N/A
11.23	Required		Installer certification information	N/A
11.24	P	X NA	Battery calculations	
11.25	P	X NA	Sample fire alarm log book	

SECTION 11.0 — FIRE DETECTION AND ALARM DATA (CONTINUED)

Supporting documents *Notes*

11.26	P	X	NA	Emergency power system specifications	
11.27	P	X	NA	Monitoring certification information	
11.28	P	X	NA	Voltage drop calculations	

SECTION 12.0 — RE-ROOF INSTALLATION DATA

NOT IN SCOPE

Construction documents *Location (sheet number or spec section)*

12.1*	Required		Site plan or building location map	

The site plan typically includes the following:

- North arrow
- A note describing the scope of work, such as tear-off, repair, overlay, etc.
- A note indicating approx. squares of roofing to be applied
- Area in which work is to be performed
- Location of roof access

12.2	Required		Occupancy classification	
12.3	Required		Type of construction	
12.4	Required		Minimum roof class required	
12.5	Required		Class of roofing to be installed	
12.6	Required		Roof plan	
12.7	P	NA	Parapet and scupper cross section(s)	

Supporting documents

12.20	Required		Pre-re-roof inspection r	
12.21	Required		Roofing system listing	
12.22	Required		Roofing manufacturer's	
12.23	Required		Roofing manufacturer's	
12.24	P	NA	Structural calculations	
12.25	P	NA	Structural engineer's report	

SECTION 13.0 — JURISDICTIONAL – SPECIFIC REQUIREMENTS

Construction documents *Item* *Location (sheet number or spec section)*

13.1	P	NA	Required	
13.2	P	NA	Required	
13.3	P	NA	Required	
13.4	P	NA	Required	
13.5	P	NA	Required	
13.6	P	NA	Required	
13.7	P	NA	Required	
13.8	P	NA	Required	
13.9	P	NA	Required	
13.10	P	NA	Required	