

Structural Calculations for Snowbasin Yurt Platforms

Location:
Weber County, UT

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Design Criteria

Yurt Roof Loading:

Snow Load:

Location:	41.22N, -111.87 W
Elevation:	6280 MSL
P _g :	112 psf
C _e :	1.0
C _t :	1.2 (assumed unheated)
C _s :	0.7 (7/12 roof pitch)
P _f :	65 psf
Sliding Snow (P _s):	18.6 psf

Dead Load: 10 psf

Deck Platform Loading:

Snow Load:

P _g :	112 psf
C _e :	1.0
C _t :	1.2 (assumed unheated)
P _f :	94 psf
P _f +P _s :	113 psf (Balanced Snow + Sliding from Yurt)

Dead Load: 6.5 psf

Live Load: 40 psf

Design Assumptions:

Design deck platform for ground snow (112 psf) and deck dead load which would produce the worst-case scenario. Yurt structure is designed by others.

YURT LOADING

30' ϕ yurt $A = 707 \phi$
20' ϕ yurt $A = 314 \phi$

30' ϕ yurt

$P_{DL} = (10)(707)(\frac{1}{3}) = 2357 \#$
 ϕ pole

$P_{SL} = (65)(707)(\frac{1}{3}) = 15,318 \#$
 ϕ pole


W sidewall S
 $W_{DL} = 10(707)(\frac{2}{3}) / \pi(30) = 50 \# / 1$
 $W_{SL} = 65(707)(\frac{2}{3}) / \pi(30) = 325 \# / 1$

20' ϕ Yurt

$W_{DL} = (314)(10) / \pi(20) = 50 \# / 1$
perimeter

$W_{SL} = 314(65) / \pi(20) = 325 \# / 1$
perimeter

30' Yurt Calculations:

 <p>208.726.5608 po box 5619 ketchum, id 83340 www.rlb-ar.com</p>	JOB <u>SNOW BASIN - YURT</u>
	SHEET NO. _____ OF _____
	CALCULATED BY <u>CC</u> DATE <u>11/3/21</u>
	CHECKED BY _____ DATE _____
SCALE <u>30' YURT</u>	

MAXIMUM CAPACITY OF 2x8 DEF-L #1 P.T. @16" OC

$$F_{bmax} = 1000(1.15)(1.2)(1.15)(0.8) \approx 1270 \text{ Psi}$$

$$F_{vmax} = 180(1.15)(0.8) = 166 \text{ Psi}$$

$$\text{SPAN} = 8'-6" - 6" = 8'-0" \text{ CLR}$$

CHK MAX. LOAD

$$1270 = \frac{C \cdot M}{1.5(7.25)^2} \Rightarrow M_{max} = 16,688 \text{ #-ft} = 1391 \text{ #-ft}$$

$$\frac{W(8)^2}{8} = 1391 \Rightarrow W = 174 \text{ \#/ft} \approx 130 \text{ PSF}$$

MAX SHEAR:

$$1.5 \left(\frac{V}{1.5(7.25)} \right) = 166 \Rightarrow V_{max} = 1204 \text{ \#}$$

$$W_{max \text{ shear}} = W(8/2) = 1204 \Rightarrow W = 30 \text{ \#/ft} < 174 \text{ \#/ft} \text{ is BENDING CONTROLS}$$

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JOB SNOW BASIN - YURT
 SHEET NO. _____ OF _____
 CALCULATED BY CC DATE 1/13/21
 CHECKED BY _____ DATE _____
 SCALE 30' YURT

FLOOR DECK - GIRDER

* DESIGN FOR FULL CAPACITY OF FLR JOISTS (CONSERVATIVE)

$$\text{LOADING} = 130 \text{ PSF (DL)} \text{ (ASD)}$$

$$\text{SPAN} = 9'-0" \text{ CLEAR}$$

$$W = 8.5(130) = 1105 \text{ \#} \text{ (DL)} \text{ CONSERVATIVE @ LL LOCATIONS}$$

$$M = 1105(9)^2/8 = 11188 \text{ \#-ft} = 134258 \text{ \#-ft}$$

$$V = 1105(9/2) = 4973 \text{ \#}$$

TRY (4) 2X12 DF-L #1 OR BTR P.T.

$$F_b = 1200(1.15)(0.8) = 1104 \text{ PSI}$$

$$F_v = 180(1.15)(0.8) = 166 \text{ PSI}$$

$$F_b = 1060 \text{ PSI} < 1104 \text{ PSI} \text{ OK}$$

$$F_v = 111 \text{ PSI} < 166 \text{ PSI} \text{ OK}$$

$$L = 40(8.5) = 340 \text{ \#}$$

$$\Delta L = \frac{5(84)(12)(9)(12)^3}{384(1.8 \times 10^6)(177.77)} = 0.157" = 1/639 \rightarrow 1/360 \text{ OK}$$

USE (4) 2X12 DF-L #1 OR BTR P.T.

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JOB SNOWBRAIN

SHEET NO. _____ OF _____

CALCULATED BY CC DATE 11/19/21

CHECKED BY _____ DATE _____

SCALE 50' X 10'

PERIMETER BEAMS

$$W = \frac{130}{2(8.5)} (8.5 + 2)^2 = 843 \# \quad (D10)$$

SPAN = 9'-0" CLEAR

$$M = 102435 \# - 11$$

$$V = 3794 \#$$

TRY (3) 2X12 DFL #1 OR ETR P.T.

$$F_b = 1200 (1.15) (0.8) = 1056 \text{ psi}$$

$$F_v = 180 (1.15) (0.8) = 166 \text{ psi}$$

$$F_t = 1079 \text{ psi} \quad 71066 \text{ psi} \quad \text{AL } 2\% \text{ OVER STRESS } \underline{OK}$$

$$F_v = 112 \text{ psi} < 166 \text{ psi} \quad \underline{OK}$$

USE (3) 2X12 DFL #1 OR ETR P.T.

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JOB SOUBHAM - YURT
 SHEET NO. _____ OF _____
 CALCULATED BY CC DATE 11/5/21
 CHECKED BY _____ DATE _____
 SCALE 50' YURT

30' YURT PAD FTG SIZES

INTERIOR PAD FTGS (WORST CASE):

P = 10498 # (DTS) ← FR LOAD
 - 295 # (D) ← 2.5' SAND TUBE
 1350 # (D) ← 3'x3' FTG
+ 2054 # (D) ← SOL
 14197 # T

BEARING STRESS ALLOWED = 1500 PSF ← ASSUMED

BEARING AREA REQ'D = $\frac{14197}{1500} = 9.46 \text{ ft}^2$

$3 \text{ ft} \times 3 \text{ ft} = 9 \text{ ft}^2 < 9.46 \text{ ft}^2 \approx 5\% \text{ OVER STRESS OK}$

USE 3'x3' PAD FTG

$A_{REQ'D} = 0.0018 (3 \times 12) = 0.726 \text{ in}^2$

$(4) \#4 = 0.785 \text{ in}^2 > 0.726 \text{ in}^2 \text{ OK USE (4) \#4 EA WAY}$

MIDDLE POST:

$P_{w/YURT} = 2357 + 6.5(8.5/2 + 9.5/2) \times 15 = 2854 \text{ \#D}$
 $\frac{15318 \text{ \#S}}{18172 \text{ \#T}}$

$P_{w/YURT} \approx 9945 \text{ \#} < 18172 \text{ \#}$

$P_T = 18172 + 295 + 1829 + 2100 = 25696 \text{ \#}$

$A_{REQ'D} = 17.13 \text{ ft}^2$

$4 \times 4 \text{ SR PAD} = 16 \text{ ft}^2 \approx 6.6\% \text{ OVER STRESS OK}$

USE 4x4 PAD FTG

$A_{REQ'D} = 1.0368 \text{ in}^2 \quad (6) \#4 = 1.14 \text{ in}^2 \text{ OR (4) \#5} = 1.24 \text{ in}^2$

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JOB SNOW BASIN

SHEET NO. _____ OF _____

CALCULATED BY CR DATE 11/4/21

CHECKED BY _____ DATE _____

SCALE 30' YURT

PERIMETER FOUNDATIONS:

$$\begin{array}{r}
 F = 7166 \# \quad (D+S) \\
 295 \# \quad (D) \\
 1426 \# \quad (D) \\
 \hline
 937 \# \quad (D) \\
 9824 \# \quad (T)
 \end{array}$$

$$A_{REQ'D} = 0.54 \text{ ft}^2$$

$$2.5' \times 2.5' \text{ PAD FTG} = 6.25 \text{ ft}^2 \approx 4.5\% \text{ OVERSTRESS} \quad \underline{OK}$$

$$A_{S_{REQ'D}} = 50(12)(0.0018) = 0.648 \text{ in}^2 \quad (4) \#4 = 0.76 \text{ in}^2 \quad \underline{OK}$$

USE 2.5' X 2.5' PAD FTG W/ (4) #4 EA WAY


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20' Yurt Calculations:

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	SHEET NO. _____ OF _____
	CALCULATED BY <u>CC</u> DATE <u>11/4/21</u>
	CHECKED BY _____ DATE _____
	SCALE <u>20' YURT</u>

20' YURT DECK JOISTS

* DECK JOIST SPAN IS SHORTER THAN 30' YURT ∴ USE SAME DESIGN

20' YURT INTERIOR FLR BEAMS

$W = 6.5 (6) = 39 \#1 D$
 $112 (6) = \frac{672 \#1 S}{711 \#1 T}$

SPAN = $8.67' - 0.5' = 8.17'$

$M = 71188 \# -11$
 $V = 2904 \#$

TRY (2) 2X12 DF-L #1 OR BTR P.T.

$F_b = 1200 (1.15) (0.8) = 1104 \text{ psi}$
 $F_v = 180 (1.15) (0.8) = 166 \text{ psi}$
 $F_b = 1125 \text{ psi} > 1104 \text{ psi} \quad \text{SO } 2\% \text{ OVERSTRESS OK}$
 $F_v = 129 \text{ psi} < 166 \text{ psi} \quad \text{OK}$

$LL = 40 (6) = 240 \#1$
 $\Delta_{LL} = \frac{5 (240/12) (8.67 \times 12)^4}{384 (1.8 \times 10^6) (556)} = 0.047" = 1/2185 \text{ OK}$

USE (2) 2X12 DF-L #1 OR BTR P.T.

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JOB SNOW BASIN
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 CHECKED BY _____ DATE _____
 SCALE 20' YURT

20' YURT INTERIOR FOUNDATIONS

$$\begin{aligned}
 P &= 39(8.67) = 338 \# \text{ D} \\
 &672(8.67) = 5826 \# \text{ S} \\
 &205 \# \text{ D} \leftarrow \text{SOUNDINGS} \\
 &938 \# \text{ D} \leftarrow \text{FTG} \\
 &\underline{1426 \# \text{ D} \leftarrow \text{SOIL}} \\
 &8733 \# \text{ (T)}
 \end{aligned}$$

$$A_{REQ'D} = 8733/1500 = 5.822 \text{ ft}^2$$

$$2.5 \times 2.5 \text{ PAD FTG} = 6.25 \text{ ft}^2 > 5.822 \text{ ft}^2$$

$$A_{SOIL REQ'D} = 30(12)(0.0018) = 0.648 \text{ ft}^2$$

USE 2.5' x 2.5' FTG W/ (4) #4 EA WAYS

20' YURT PERIMETER PAD FTGS

$$\begin{aligned}
 P &= 300 \# \text{ D} \\
 &5178 \# \text{ S} \\
 &205 \# \text{ D} \leftarrow \text{SOUNDINGS} \\
 &600 \# \text{ D} \leftarrow \text{FTG} \\
 &\underline{864 \# \text{ D} \leftarrow \text{SOIL}} \\
 &7142 \# \text{ T}
 \end{aligned}$$

$$A_{REQ'D} = 7142/1500 = 4.765 \text{ ft}^2$$

$$2.25' \times 2.25' \text{ PAD FTG} = 5.0625 \text{ ft}^2 > 4.765 \text{ ft}^2 \text{ OK}$$

USE 2.5' x 2.5' PAD FTG

$$A_{SOIL REQ'D} = 0.585 \text{ ft}^2 \quad (3) \#4 = 0.61 \text{ ft}^2 > 0.585 \text{ ft}^2 \text{ OK}$$

(3) #4 EA WAY

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 CHECKED BY _____ DATE _____
 SCALE 20' YURT

20' YURT PERIMETER BEAMS

$W = \frac{6.5}{2(6)} (6+2)^2 = 35 \#1 D$

$\frac{11.2}{2(6)} (6+2)^2 = 59.7 \#1 S$
 632 #1 T

SPAN = 8.67' - 0.5' = 8.17' CLEAR

M = 632 77 #11 < 711 BB #11 ← LESS THAN INTERIOR BEAMS

V = 2532 # < 2904 ← " "

USE (2) 2X12 DF-L #1 OR 3TR P.I.

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