

City of Puyallup
Building
ACCEPTED

JMontgomery
02/08/2023
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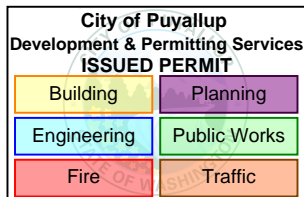
STRUCTURAL CALCULATIONS
FOR
THE LOCKWOOD RESIDENCE REMODEL
3305 S FRUITLAND AVE
PUYALLUP, WA98373

January 24, 2023
BNT JOB NO. 23002

THE APPROVED CONSTRUCTION PLANS,
DOCUMENTS AND ALL ENGINEERING MUST
BE POSTED ON THE JOB AT ALL
INSPECTIONS IN A VISIBLE AND READILY
ACCESSIBLE LOCATION.

FULL SIZED LEDGIBLE COLOR PLANS ARE
REQUIRED TO BE PROVIDED BY THE
PERMITEE ON SITE FOR INSPECTION

BUILDER:
FULL TILT CONSTRUCTION
10751 A Street South
Tacoma, WA 98444
CONTACT: PAUL LOCKWOOD
(425) 533-7315



BUILDING CODES:

2018 IBC
ASCE7-16

GRAVITY LOADS:

Roof :

COMPOSITION ROOFING	2.5	PSF
1/2" PLYWOOD	1.5	PSF
FRAMING @ 24"o.c.	3.0	PSF
INSULATION	2.0	PSF
GYPBOARD CEILING	2.8	PSF
MECH & ELEC	1.0	PSF
SPRINKLERS	0.0	PSF
MISC.	1.0	PSF
TOTAL DL =	14	PSF
x Slope factor =	15	PSF
TOTAL LL [SNOW - min] =	25	PSF
TOTAL Roof DESIGN LOAD =	40	PSF

ROOF SLOPES:

RISE =	5
RUN =	12
m =	1.083

DECK SLOPE:

RISE =	0.25
RUN =	12
m =	1.000

LD DUR = 115% [FOR WOOD MEMBERS]

Floor :

3/4" PLYWOOD	2.7	PSF
FRAMING @ 16"o.c.	3.0	PSF
GYPBOARD CEILING	2.8	PSF
SPRINKLERS	0.0	PSF
MECH & ELEC	2.0	PSF
MISC.	1.0	PSF
TOTAL DL =	12	PSF
TOTAL LL =	40	PSF
TOTAL Floor DESIGN LOAD =	52	

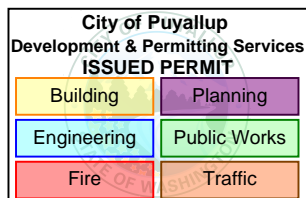
Deck :

3/4" PLYWOOD	2.7	PSF
FRAMING @ 16"o.c.	3.0	PSF
MISC.	4.0	PSF
TOTAL DL [Wood] =	10	PSF
TOTAL LL =	60	PSF
TOTAL Deck DESIGN LOAD =	70	PSF

LL @ EXITS = 100 PSF

WALL TYPES:

WOOD STUD	10	PSF
8" CONCRETE	100	PSF
10" CONCRETE	125	PSF



LATERAL LOADS:

BUILDING RISK CATEGORY II

EXPOSURE & GUST FACTOR "Ce" = Height

WIND:		1.12	45 ft
BASIC WIND SPEED V (MPH) =	110	1.09	40 ft
Exposure =	B	1.05	35 ft
Wind Importance Factor I =	1.0	1.00	30 ft
Kzt =	1.0	1.00	25 ft
Load Factor for ASD combinations =	0.6	1.00	20 ft
		1.00	15 ft

ASCE7-10 2.4.1 EQ. 5. & 7.

SEISMIC:

CITY: Puyallup - 373 ZIP CODE: 98373

(Site Class "D" - Seismic Design Category "D")

Ss =	1.271	g	REDUNDANCY FACTOR (rho) =	1.0
S1 =	0.439	g	SYSTEM OVERSTRENGTH FACTOR =	2.5
Fa =	1.200		FACTOR FOR PLAN IRREGULARITY =	1.0
Fv =	NULL			
SDS =	1.017	g		
SD1 =	NULL	g		
Load Factor for ASD combinations =	0.70			

ASCE7-10 2.4.1 EQ. 5. & 8.

Rbrg walls =	6.5	[PLYWOOD SHEARWALLS]
Importance Factor I =	1.0	

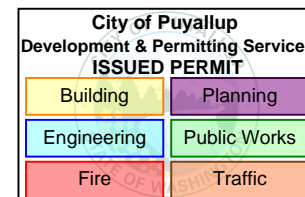
$v = 0.110 \times W$

BUILDING GEOMETRY:

DIMENSIONS:

LENGTH (FT) =	56.00
WIDTH (FT) =	44.00

LEVEL:	Roof	Level 2	Level 1
LENGTH (FT) =	59.0	56.0	56.0
WIDTH max (FT) =	47.0	44.0	44.0
AVERAGE HEIGHT (FT) =	25.25	9.08	0.00
Overhang (FT) =	1.5	N.A.	N.A.
WALL HT (FT) =	8.08	8.08	0.0
AREA (FT^2) =	2,260	1,415	N.A.



BUILDING GEOMETRY (CONT'D):

GRID DIMENSIONS:

LONGITUDINAL

1	2	3	4	5
0.00	3.00	23.00	40.00	44.00

TRANSVERSE

A	B	C	D	E	F
0.00	2.17	18.0	26.0	36.67	56.0

MATERIAL PROPERTIES

FOUNDATION:

qa (psf) = 1,500

soil weight (pcf) = 110
 weight of water (pcf) = 62.4

Lateral soil Loads

E.F.P. (active - unrestrained) (pcf) = 35
 P. (active - unrestrained) sloping Backfill (pcf) = 50
 E.F.P. (at-rest) (pcf) = 55

E.F.P. (PASSIVE) = 330
 Coefficient of friction (sliding) = 0.35

6 X "H" added to active - for seismic "active"
 9 X "H" added to active - for seismic "at-rest"

CONCRETE:

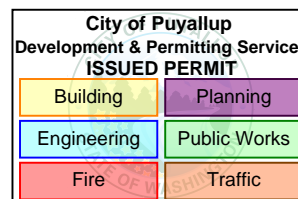
Slabs on Grade fc (psi) = 2,500
 Retaining Walls & Ftgs fc (psi) = 3,000
 fs (psi) = 60,000

weight (pcf) = 150
 t S.O.G. (in) = 4
 Ec (psi) = 1.43E+08

STEEL:

WF & WT Shapes - Fy (psi) = 50,000
 HSS Shapes - Fy (psi) = 46,000
 Channels & Angles - Fy (psi) = 36,000
 Pipes - Fy (psi) = 36,000

Footing Schedule			
Mark	Width (ft)	Length (ft)	Capacity (lb)
F1.5	1.5	1.5	3,375
F2.0	2.0	2.0	6,000
F2.5	2.5	2.5	9,375
F3.0	3.0	3.0	13,500
F3.5	3.5	3.5	18,375
F4.0	4.0	4.0	24,000
F4.5	4.5	4.5	30,375
F5.0	5.0	5.0	37,500



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FLOOR:

$$\begin{aligned} D.L. &= 12 \text{ psf} \\ L.L. &= 40 \text{ psf} \\ \hline &= 52 \text{ psf} \end{aligned}$$

JOISTS:

2x12's

$$\begin{aligned} A &= 16.875 \text{ in}^2 \\ S &= 11.641 \text{ in}^3 \end{aligned}$$

$$\text{SPAN} = 17.0 \text{ (MAX)} \quad W = .070 \text{ ft}$$

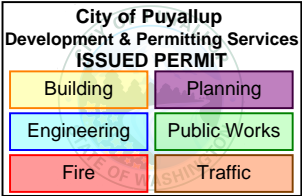
$$V = \frac{.070 \text{ ku} (17')}{2} = 588 \text{ k}$$

$$A_p = 9.28 \text{ in}^2 < 16.875 \text{ in}^2$$

$$M = \frac{.070 \text{ ku} (17')^2}{8} = 2.57 \text{ k-ft}$$

$$S_p = \frac{2.57 \text{ k-ft} (12)}{1.0 \text{ ksi}} = 30.84 \text{ in}^3 < 11.641 \text{ in}^3$$

∴ 2x12's D.F. #2 @ 16" O.C. O.K.



CHECK GUB'S

(W) 5 1/2 x 12 GUB'S

$$\begin{aligned} A &= 66.0 \text{ in}^2 \\ S &= 172.0 \text{ in}^3 \\ I &= 792 \text{ in}^4 \end{aligned}$$

$$F_{TG} = \sqrt{\frac{5.85 \text{ k}}{1.5 \text{ ksi}}} = 1.97 \text{ ft}$$

F.M.O

$$\text{SPAN}_1 = 16.5' \quad W = .709 \text{ ft}$$

$$V = \frac{.709 \text{ ku} (16.5')}{2} = 585 \text{ k}$$

$$A_p = \frac{1.5 (5.85 \text{ k})}{2} = 57.18 \text{ in}^2$$

$$M = \frac{.709 \text{ ku} (16.5')^2}{8} = 24.17 \text{ k-ft}$$

$$S_p = \frac{24.17 \text{ k-ft} (12)}{2.4 \text{ ksi}} = 120.04 \text{ in}^3$$

$$\Delta_{TOT} = \frac{0.0125 (.709) 16.5^4}{792 \text{ in}^4} = .029 \text{ in}$$

[2/20]

∴ 5 1/2 x 12 GUB O.K.

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(C) 5 1/2 x 16 GUB

$A = 88.0 \text{ in}^2$
 $S = 274.7 \text{ in}^3$
 $I = 1,877.7 \text{ in}^4$

$\text{SPAN}_2 = 21.77'$ $w = .774 \text{ k/ft}$

$V = .774 \text{ k/ft} (21.77') = 8.25 \text{ k}$

$A_p = 1.5 \frac{(8.25 \text{ k})^2}{165} = 75.0 \text{ in}^2$

$M = .774 \text{ k/ft} (21.77')^2 = 44.02 \text{ k-ft}$

$f_{tq} = \sqrt{\frac{8.25 \text{ k}}{1.5 \text{ ft}^4}} = 2.75 \text{ ksi}$

$S_p = \frac{44.02 \text{ k-ft} (12)}{2.4 \text{ ksi}} = 220.1 \text{ in}^3$

$\therefore f_{3.0}$

$\Delta_{tt} = \frac{0.025 (.774) 21.77^3}{1,877.7} = 1.07 \text{ in}$
[L/240]

$\therefore 5 1/2 \times 16 \text{ GUB O.K.}$

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

HEADERS:

4x12 (south) HDRS:

$V = 2.24 \text{ k}$ $A_p = 35.77 \text{ in}^2$ $w = .180 + .100 = .280 \text{ k/ft}$
 $M = 8.96 \text{ k-ft}$ $\text{SPAN}_1 = 16.0'$ $\text{SPAN}_2 = 8.0'$
 $S_p = 107.52 \text{ in}^3$ $\leftarrow 5 1/2 \times 12 \text{ GUB}$
 $\leftarrow 4 \times 12 \text{ O.K.}$

SELECT 5 1/2 x 12 GUB!

(W) 4x10 HDR:

$w = .060 \text{ k/ft}$
 $\text{SPAN} = 5.0'$
 $V = 2.15 \text{ k}$ $A_p = 37.94 \text{ in}^2$
 $M = 2.68 \text{ k-ft}$ $S_p = 27.75 \text{ in}^3$

SELECT 4x10 D.F. #2

PORCH FRAMING:

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Building	Planning
Engineering	Public Works
Fire	Traffic

$$\begin{aligned} \text{SPAN} &= 4.87' \\ W &= .097 \text{ ksf} \\ V &= .233 \text{ k} \\ M &= .291 \text{ kft} \\ A_c &= 7.08 \text{ in}^2 \\ S_x &= 7.48 \text{ in}^3 \end{aligned}$$

∴ 2X10 H.F. #2 @ 16" o/c

CHECK BEAMS:

$$\begin{aligned} \text{SPAN} &= 11.5' \quad W = .175 \text{ ksf} \\ V &= 1.00 \text{ k} \quad A_c = 15.89 \text{ in}^2 \\ M &= .175 \text{ kft} (11.5') = 2.01 \text{ kft} \\ S_x &= \frac{2.01 \text{ kft} (12)}{1.0 \text{ ft}^3} = \underline{24.12} < 49.91 \text{ in}^3 \end{aligned}$$

SELECT 4X10 D.F. #2

$$A_c = 32.37 \text{ in}^2 \quad S_x = 49.91 \text{ in}^3$$

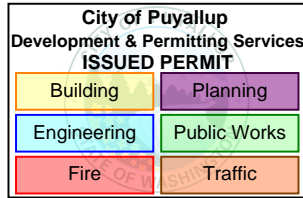
$$FTG. = \sqrt{\frac{9.75' (.175 \text{ ksf})}{1.5}} = \sqrt{\frac{1.7 \text{ k}}{1.5}} = 1.1 \text{ ft}^2 \approx \underline{F2.0}$$

CHECK STUDS:

$$\begin{aligned} W &= \frac{.052 \text{ ksf} (17')}{2} + \frac{.040 \text{ ksf} (23.92')}{2} + .200 \text{ ksf} \\ W &= 1.02 \text{ ksf} (1.72' o/c) = \underline{1.75 \text{ k/ft}^2} \end{aligned}$$

$$F_c = \frac{0.7 (1700)}{\left[\frac{9.08' (12)}{5.5} \right]^2} = .994 \text{ ksf} \quad f_c = \frac{1.75 \text{ k}}{0.25 \text{ in}^2} = 1.63 \text{ ksf}$$

∴ 2X6 STUDS @ 16" o/c O.K. ✓



ENCLOSED STRUCTURE, WIND SPEED = 110 MPH, EXPOSURE B - METHOD 1

Simplified Design Wind Pressure, ps30 (psf) (Exposure B at h = 30 ft, I = 1.0)

		ZONES									
		Horizontal Pressures				Vertical Pressures				Overhangs	
Roof Angle (degrees)	Load Case	A	B	C	D	E	F	G	H	E OH	G OH
0 - 5	1	19.3	-9.9	12.7	-5.9	-23.1	-13.1	-16.1	-10.2	-32.3	-25.3
10	1	21.6	-9.0	14.4	-5.2	-23.1	-14.1	-16.1	-10.9	-32.3	-25.3
15	1	24.1	-8.0	16.1	-4.5	-23.1	-15.1	-16.1	-11.6	-32.3	-25.3
20	1	26.6	-7.0	17.8	-3.9	-23.1	-16.1	-16.1	-12.2	-32.3	-25.3
25	1	24.1	3.9	17.4	4.0	-10.7	-14.6	-7.7	-11.7	-19.9	-16.9
	2	---	---	---	---	-4.0	-7.9	-1.2	-5.0	---	---
30 - 45	1	21.6	14.7	17.1	11.7	1.7	-13.1	0.5	-11.2	-7.5	-8.7
	2	21.6	14.7	17.1	11.7	8.4	-6.5	7.2	-4.7	-7.5	-8.7

WIND LOAD FACTORS:

Wind Importance Factor $I = 1.0$ $Kzt = 1.00$
 $\lambda = 1.00$ (max) **Load Factor for ASD combinations = 0.60** **ASCE7-10 2.4.1 EQ. 5. & 7.**

Building Dimensions:

L (ft) = 56.00
 T (ft) = 44.00
 Mean Roof Height (ft) = 21.21
 wall ht (ft) = 17.17
 roof ht (ft) = 25.25

Determine "a":

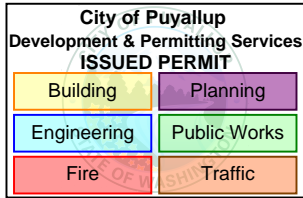
10% of B (ft) = 4.40
 40% of h (ft) = 8.48
 4% of B (ft) = 1.76
 a (ft) = 4.40

Roof Angle (deg) = 22.62

Interpolation:

High Value (deg) = 25
 Low Value (deg) = 20

Interpolation Factor = 0.52



ENCLOSED STRUCTURE, WIND SPEED = 110 MPH, EXPOSURE B - METHOD 1

Tansverse forces

		ZONES									
		Horizontal Pressures				Vertical Pressures				Overhangs	
Roof Angle (degrees)	Load Case	A	B	C	D	E	F	G	H	E OH	G OH
22.62	1	15.19	-0.80	10.55	0.16	-9.97	-9.17	-7.01	-7.18	-15.50	-12.54

Longitudinal forces

		ZONES									
		Horizontal Pressures				Vertical Pressures				Overhangs	
Roof Angle (degrees)	Load Case	A	B	C	D	E	F	G	H	E OH	G OH
22.62	1	15.19	-0.80	10.55	0.16	-9.97	-9.17	-7.01	-7.18	-15.50	-12.54

WIND FORCES

2a (ft) = 8.8

Roof (ft) = 47.00
T Level 2 (ft) = 44.00

Roof (ft) = 59.00
L Level 2 (ft) = 56.00

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Transverse Forces

Level	Height (ft)	Wall Height (ft)	Ht/Exp Factor (lambda)	Zone A	Zone B	Zone C	Zone D	Total Shear (lb)
				Minimum Dsn Pressure (psf)	Minimum Dsn Pressure (psf)	Minimum Dsn Pressure (psf)	Minimum Dsn Pressure (psf)	
				16	8	16	8	
Roof	25.25	8.08	1.00	65	65	65	65	7,631
Level 2	9.08	8.08	1.00	137	----	137	----	7,690
TOTAL BASE SHEAR (lb) =								15,321

Longitudinal Forces

Level	Height (ft)	Wall Height (ft)	Ht/Exp Factor (lambda)	Zone A	Zone B	Zone C	Zone D	Total Shear (lb)
				Minimum Dsn Pressure (psf)	Minimum Dsn Pressure (psf)	Minimum Dsn Pressure (psf)	Minimum Dsn Pressure (psf)	
				16	8	16	8	
Roof	25.25	8.08	1.00	65	65	65	65	6,079
Level 2	9.08	8.08	1.00	137	----	137	----	6,042
TOTAL BASE SHEAR (lb) =								12,121

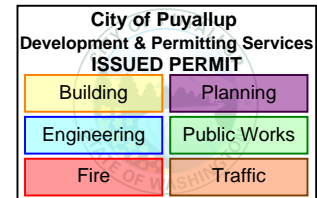
SEISMIC FORCES

Level	Height	Area (sf)	DL (psf)	Addtnl DL (psf)	Weight (lb)	W*H	W*H / Sum(W*H)	V (lb)	v (psf)
Roof	17.17	2,260	15	2	38,307	657,578	0.791	4,974	2.20
Level 2	9.08	1,415	12	2	19,103	173,508	0.209	1,312	0.93
		3,675			57,410	831,086	1.000	6,286	

Check governing forces for short shearwalls (h/l < or = 3.5)

Transverse Direction: EQ/Wind = 0.41 x 1.75 = **0.72** **O.K.**
 Longitudinal Direction: EQ/Wind = 0.52 x 1.75 = **0.91** **O.K.**

WIND FORCES GOVERN IN TRANSVERSE DIRECTION
WIND FORCES GOVERN IN LONGITUDINAL DIRECTION



'ALL & HOLDOWN VALUES

Shearwall Schedule				
Shearwall Types (plf):	1/2" GYP OR 15/32" PLYWOOD Capacity (plf)		Nailing	Max Stud Spacing (in)
	Seismic	Wind		
Type G-1	125	125	5d cooler @ 7"o.c	N.A.
Type G-2	150	150	5d cooler @ 4"o.c	N.A.
Type P-1	240	340	8d @ 6"o.c.	N.A.
Type P-2	350	495	8d @ 4"o.c.	N.A.
Type P-3	1280	1790	8d @ 2"o.c. E.S.	N.A.
Type P-4	1460	2045	8d @ 2"o.c. E.S.	N.A.

(USE STRUC I PLYWOOD FOR TYPE P-4 WALLS)

Holdown Straps (for wood framing)		
Mark	Capacity (lb)	NOTES
MSTC28	1,325	(16) 16d Sinkers
MSTC40	2,650	(32) 16d Sinkers
MSTC66	5,840	(68) 16d Sinkers
MST72	6,475	(62) 16d Sinkers

Holdowns (for concrete)			
Mark	Capacity (lb)	NOTES	
HDU2-SDS2.5	2,215	(6) 1/4" x 2 1/2" SDS	DBL STUD MIN
HDU5-SDS2.5	4,065	(14) 1/4" X 2 1/2" SDS	DBL STUD MIN
HDU8-SDS2.5	5,020	(20) 1/4" x 2 1/2" SDS	4 X 4 POST MIN
HHDQ11-SDS2.5	11,810	(24) 1/4" x 2 1/2" SDS	6 X 6 POST MIN

EXTERIOR WALLS @ GRID C																	UPLIFT DUE TO WIND FORCES AT TOP STORY SHEARWALLS					
dx	Trib Length (ft)	Trib Width (ft)	% Shear	Total Shear (lb)	Mark	wall length (ft)	wall height (ft)	minimum shearwall length (ft)	v (plf)	Wall Type	v allowable (plf)	OTM (lb-ft)	Mr (lb-ft)	Uplift from above (lb)	uplift (lb)	Holdown	Max Anchor bolt spacing (ft)	Net uniform uplift (plf)	Drag Forces (lb)	Omega	% to Drag	
Roof	47.00	21.32	48.6%	3,710	1	2.67	8.08	2.31	252	Type P-1	340	O.K.	5,688	5,564	N.A.	57	Not Req'd	2.6	70	168	1.0	25%
					2	10.83	8.08	2.31	232	Type P-1	340	O.K.	20,298	34,399	N.A.	-1,365	Not Req'd	2.8	99	628	1.0	25%
					3	2.50	8.08	2.31	269	Type P-1	340	O.K.	5,579	5,153	N.A.	213	Not Req'd	2.4	45	168	1.0	25%
						16.00																
Level 2	21.00	9.34	14.2%	4,801	1	13.33	8.08	2.31	360	Type P-2	495	O.K.	38,809	18,951	0	1,548	HDU2-SDS2.5					
						13.33																

INTERIOR WALLS @ GRID E																	
dx	Trib Length (ft)	Trib Width (ft)	% Shear	Total Shear (lb)	Mark	wall length (ft)	wall height (ft)	minimum shearwall length (ft)	v (plf)	Wall Type	v allowable (plf)	OTM (lb-ft)	Mr (lb-ft)	Uplift from above (lb)	uplift (lb)	Holdown	
Level 2	40.00	19.00	55.0%	4,847	1	24.50	8.08	2.31	143	Type P-1	340	O.K.	28,229	89,182	0	-2,540	Not Req'd
					2	9.50	8.08	2.31	143	Type P-1	340	O.K.	10,946	20,291	0	-1,038	Not Req'd
						34.00											

EXTERIOR WALLS @ GRID F																	UPLIFT DUE TO WIND FORCES AT TOP STORY SHEARWALLS					
Level	Trib Length (ft)	Trib Width (ft)	% Shear	Total Shear (lb)	Mark	wall length (ft)	wall height (ft)	minimum shearwall length (ft)	v (plf)	Wall Type	v allowable (plf)	OTM (lb-ft)	Mr (lb-ft)	Uplift from above (lb)	uplift (lb)	Holdown	Max Anchor bolt spacing (ft)	Net uniform uplift (plf)	Drag Forces (lb)	Omega	% to Drag	
Roof	47.00	19.00	43.3%	3,306	1	10.50	8.08	2.31	107	Type P-1	340	O.K.	9,050	29,629	N.A.	-2,058	Not Req'd	6.1	-35	280	1.0	25%
					2	4.33	8.08	2.31	107	Type P-1	340	O.K.	3,732	8,953	N.A.	-1,363	Not Req'd	6.1	-35	115	1.0	25%
					3	16.17	8.08	2.31	107	Type P-1	340	O.K.	13,937	56,835	N.A.	-2,738	Not Req'd	6.1	-35	431	1.0	25%
						31.00																
Level 2	44.00	9.67	30.8%	5,673	1	2.33	8.08	2.31	1439	Type P-3	1790	O.K.	27,103	5,852	0	11,612	HHDQ11-SDS2.5					
					2	2.58	8.08	2.31	1300	Type P-3	1790	O.K.	27,103	6,583	0	9,865	HHDQ11-SDS2.5					
						4.91																

Roof	2,061	SF	100.0%
Level 2	1,381	SF	100.0%