

STRUCTURAL CALCULATIONS

for

Roper Nelson Garilyn West Weber
Post Frame Building
195 South 3600 West
West Weber, Utah

for

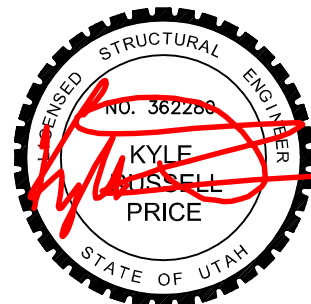
Roper Buildings
801-540-5586

Date: 9/29/2022



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3677 N. Hwy 126, Suite 4B
Farr West, UT 84404



09/29/2022

Project: Roper Nelson Garilyn West Weber
Analysis: K. Price
Date: 09/29/22



DESIGN CRITERIA

Structure Type: Light Wood Framed, Concrete Footing

Design Codes: 2018 IBC, Risk Category I

City, County or Area: Taylor

Live Loads:

40	psf for	Framed Floors (if applicable)
40	psf for	Framed Storage (If Applicable)

Snow Loads:

Pg:	43	Ce:	1.0	Ct:	1.2	I:	0.8
Cs:	0.94						

$Ps \Rightarrow (Pg * Cs * Ce * Ct * I * 0.7)$

$Ps = 30$ psf

Wind Loads:

Exposure:	C	Risk	1.0
Design Speed:	105	mph (3 Second Gust)	

Seismic Loads:

Sms:	1.23	SDC:	D	Site Class:	D
Sm1:	0.64	R:	1.5	I:	1.00
Sds:	0.82	R:	2.5		

(Cant'd Posts)
(Shear Walls)

Dead Loads:

3	psf for	Roof Structure (Rafters, Corr Metal Panels)
3	psf for	Walls (2x Girts, Corr Metal Panels)
10	psf for	Framed Floors (as applicable)

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Deflection Criteria:

	Total Load	Live Load		
L/	120	120	for:	Roof Structure
L/	120	120	for:	Floor Structure (Minimum)
Exterior Walls Considered Flexible				

SOIL DESIGN PROPERTIES

*Geotechnical Study

Or Investigation by: N/A

Date of Report: N/A

Proj No. of Report: N/A

Foundation Type: Concrete Pier Footing

*Bearing Pressure (Qa): 1500 psf

**Allow. Lateral Pressure: 533 psf/sf

*Coeff. of Friction: 0.35 alone

*Design Values are assumed if no Geotechnical Study or Investigation is provided or does not provide values.

*Price Engineering assumes stable soil characteristics.

*All design is based on stable soil characteristics meeting the unified soil classification types GW, GP, SW, SP

*Soils found on site while excavation occurs which differ from those stated above should be brought to the attention of Price Engineering before and foundation or footing systems are installed.

**Soils assumed to be GW or GP, with a 33% increase for short term lateral loads and multiplied by 2 per IBC 1806.3.4.

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MATERIAL SPECIFICATIONS

Reinforcing Steel: ASTM A615, Grade 60
ASTM A706, Grade 60 Weldable Rebar
Welded Wire Fabric: ASTM A185
Anchor Bolts: ASTM A307 or better, Zinc Coated
Wood Bolts: ASTM A307 or better, Zinc Coated

Concrete Strengths:	(F'c Design @ 28 Days)	(F'c Recommended @ 28 Days)
Footings:	2500 psi	3000 psi
Walls:	2500 psi	3000 psi
Piers:	2500 psi	3500 psi
Slabs on Grade:	3500 psi	3500 psi

Concrete Masonry:

Units: ASTM C90 Medium Weight, Grade N-1

Mortar: Type "S" conforming to IBC Table 2103.7

Grout: Compress. Strength @ 28 days: 1800 psi

Sawn Lumber: Doug Fir North or Hem Fir

Use Stamped Grade, Spec, or Value (Minimum)

Wall Studs: Stud
Posts: Grade #1
Joists & Rafters & Purlins: Grade #2
Other: Grade #2
Preservative Treated: For Concrete Contact, 0.2 Spec, Gound Contact, 0.4 Spec (See lumber tag)

Engineered and Manufactured Lumber Products:

Product Stamped Grade, Spec, or Value
Glulam Beam: 24F-V4, 24F-V8
LVL: 1.9E, Fb 2600
LSL: 1.3E, Fb 1900
PSL: 1.8E, Fb 2400

Sheathing & Panels: All Panels & Sheathing shall be APA Rated & Stamped
All Roof, Floor, and Wall Panels are OSB structural with Exposure 1 treated

Structural Nails: Hot dipped zinc-coated galvanized steel, stainless steel, silicon bronze, or copper
Common wire or other galvanized acceptable for preservative treated wood.

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Diaphragm Description **Main 40 X 36 Building Roof**

Wind Loading Calculations

Wind Speed	105	mph, 3 sec. gust
Exposure	C	
Risk	1.00	
Kz	0.90	
Topo Factor (Kzt)	1.00	

Traverse Dimension (w)	40	ft
Long. dimension (L)	36	ft
Ridge Hieght	19	ft
Eave Hieght	13	ft
Roof Rise	4	ft
Roof Run	12	ft
Roof Slope	18.4	degrees

	Gable	Long.	
sum Ps=	2,504	3,469	Base Ea Wall
sum Ps=	986	2,195	Top Ea Wall
	Uplift	-46	plf

Basic Load Combonations
 (Engineer may compare w/ NDS factors)

Roof DL	3	psf
Col Trib (Spacing)	12	ft
Col Trib Roof	168	sq ft
Roof Snow	30	psf

	Axial	Moment
D+S	5544	0
D+0.6*W	504	1712
D+(0.6*W)+.75S	4284	1284

Project: **Roper Nelson** Garilyn West Weber
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Wind Cantilever System

No. Columns	20	20	
Col Ht	13	10	ft (Eave Ht. - 1 ft.)
Col Depth	5.75	5.375	in
Col. Width	5.75	6	in
Col Area	33.0625	32.25	sq
Col. F'b	1248	907.2	psi
Col 'E	1040000	1550000	psi
Col F'c	782	1550	psi

Col Sx/y Trav	32	32
Col Sx/y Long	32	29

Axial Load	5544	5544	lbs, Ea Column
Moment	1712	1317	lb*ft Ea Column
fb	649	547	psi
fc	168	172	psi
c	0.8	0.9	
Fce	1161	2556	psi
Cp	0.808	0.894	
F'c	631	1386	psi

ratio	0.678	0.662
check	OK	OK

(See Shear Wall System if NG)

Allowable Lat. Load	533	psf
A	0.289	
P	132	lbs
Provide	2	ft Wide Pier
Provide	2.2	ft Deep Pier
Provide	26.1	in. Deep Pier

Wind Shear Wall System

Shear Walls		
Width Total	12	ft
Length Total	0.0	ft
Allowable Shear	116	plf
Wind Factor	1.4	
Width Allow Total	1948.8	lbs
Length Allowable Total	0	lbs

Check Width	OK
Check Length	NG

(See Cant. System if NG)

Column Uplift

Column Ht	13	ft
Shear Wall Width	12.0	ft
Design Shear	2195	lbs.
Total Uplift	#DIV/0!	lbs
Pier Diameter	2.0	ft
Requ'd Pier Depth	#DIV/0!	in.

Assumed Allow. Bearing Press	1500	psf
Depth	3	ft
Soil Density	120	pcf
Allow. End Bearing @ Depth	1860	psf
Controlling Axial Load	5,544	lbs
Bolts Req'd	2.3	Bolts
Pier Dia Req'd	1.9	ft

Project: Roper Nelson Garilyn West Weber	
Analysis: K. Price	
Date: 09/29/22	

Tables & Load Sumations

105	Design Wind Pressures							
	A	B	C	D	E	F	G	H
5	17.5	-9.1	11.6	-5.4	-21	-11.9	-14.6	-9.2
10	19.7	-8.2	13.1	-4.8	-21	-12.8	-14.6	-9.2
25	21.9	3.5	15.9	3.6	-9.7	-13.3	-7.1	-10.7
30	19.7	13.4	15.6	10.8	7.6	-11.9	6.6	-10.3

115	Design Wind Pressures							
	A	B	C	D	E	F	G	H
15	26.3	-8.7	17.5	-5	-25.2	-16.5	-17.5	-12.6
20	29	-7.7	19.4	-4.2	-25.2	-17.5	-17.5	-13.3
25	26.3	4.2	19.1	4.3	-11.7	-15.9	-8.5	-12.8
30	23.6	16.1	18.8	12.9	9.1	-14.3	7.9	-12.3

150	Design Wind Pressures							
	A	B	C	D	E	F	G	H
15	44.8	-14.9	29.8	-8.5	-42.9	-28	-29.8	-21.4
20	49.4	-13	32.9	-7.2	-42.9	-29.8	-29.8	-22.6
25	44.8	7.2	32.4	7.4	-19.9	-27.1	-14.4	-21.8
30	40.1	27.4	31.9	22	15.4	-24.4	13.4	-20.9

105	19.70	-8.20	13.10	-4.80	-21.00	-12.80	-14.60	-9.20
115	26.30	-8.70	17.50	-5.00	-25.20	-16.50	-17.50	-12.60
150	44.80	-14.90	29.80	-8.50	-42.90	-28.00	-29.80	-21.40

Applic. Press. For **105** mph gust

	19.70	-8.20	13.10	-4.80	-21.00	-12.80	-14.60	-9.20
Ps' =	17.73	-7.38	11.79	-4.32	-18.90	-11.52	-13.14	-8.28

Calc'd Zone Areas (sf)

	A	B	C	D	E	F	G	H
Transverse	94	43	374	173	144	144	576	576
Longitudinal	104	-	432	-	144	144	576	576

Calc'd Zone Loads (lbs)

	A	B	C	D	E	F	G	H
Transverse	1660	-319	4414	-746	-2722	-1659	-7569	-4769
Longitudinal	1844	-	5093	-	-2722	-1659	-7569	-4769

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Earthquake Loading Calculations

V=	(SDS)(Fa)(W)(2/3)/R	<i>Seismic Base Shear</i>
SDS=	(2/3)SMS	<i>Design Spectral Response Acceleration</i>
SMS=	Fa(SS)	<i>Max Considered Spectral Response Acceleration</i>
SS=	1.230	<i>Short Period Spectral Acceleration</i>
S1=	0.64	<i>1 Second Period Spectral Acceleration</i>
Fa=	1.00	<i>Site Coefficient for Short Period Acceleration</i>
	D	<i>Site Class (Assumed if no Soils Report)</i>
	D	<i>Seismic Design Category</i>
	No	<i>Soils Investigation Required?</i>

Diaphragm Description **Main 40 X 36 Building Roof**

Wall DL	3	psf
Floor DL	0	psf
Roof DL	3	psf
Roof SL	0	psf

(Applicable Portion)

Cantilever System

Traverse Dimension (w)	40	ft
Long. dimension (L)	36	ft
Eave Height	13	ft

R=	1.5	RMC
V=	0.5467	(W)
E*.07=	0.383	(W)
V=	3922	lbs. @ base Total
V=	2787	lbs. @ top Total

Shear Wall System

Traverse Dimension (w)	40	ft
Long. dimension (L)	36	ft
Eave Height	13	ft

R=	2.5	RMC
V=	0.3280	(W)
E*.07=	0.230	(W)
V=	1176	lbs. @ base
V=	836	lbs. @ top

Basic Load Combinations
 (Engineer may compare w/ NDS factors)

Ea.Col	
Col Trib	12 ft
Col Trip Roof	240 sq ft
Roof Snow	30 psf

	Axial	Moment
D+S	7920	0
D+.7E	720	1812
D+.75(.7E)+.75S	6120	1359

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Seismic Cantilever System

No. Columns	20	20	
Col Ht	13	10	ft (Eave Ht. - 1 ft)
Col Depth	5.75	5.375	in
Col. Width	5.75	6	in
Col Area	33.0625	32.25	si
Col. F'b	1248	907.2	psi
Col 'E	1040000	1550000	psi
Col F'c	782	1550	psi
Col Sx	32	29	

Mom Ea Col	1812	1394	lb*ft
Axial Load	720	720	lbs, Ea Column

fb	686	579	psi
fc	22	22	psi
c	0.8	0.9	
Fce	1161	2556	psi
Cp	0.808	0.894	
F'c	631	1386	psi

ratio	0.562	0.644	
Check	OK	OK	

Allowable Lat. Load	533	psf
A	0.306	
P	139	lbs
Provide	2	ft Wide Pier
Provide	2.2	ft Deep Pier
Provide	26.9	in. Deep Pier

Seismic Shear Wall System

Width Total	12	ft
Length Total	0.0	ft
Allowable Shear	116	plf

Width Allow Total	1392	lbs
Length Allowable Total	0	lbs

Check Width	OK
Check Length	NG

Column Uplift

Column Ht	13	ft
Shear Wall Width	12.0	ft
Design Shear	836	lbs.
Total Uplift	#DIV/0!	lbs

Pier Diameter	2.0	ft
Requ'd Pier Depth	#DIV/0!	in.

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BEAM

GABLE COL

INPUT

<u>BEAM PARAMETERS</u>		<u>LOADING</u>		LL	DL	LOAD DIST.	<u>DEFLECTION LIMITS</u>	
BEAM TABLE NO.	141	W (PLF)	74.20	0	0	FROM LEFT	LL, L/	120
QUANTITY	1	W FROM LEFT (LBS)	0	0	0	WA, RIGHT WC,	TL, L/	120
SPAN (FT)	13.0	W FROM RIGHT (LBS)	0	0	0	TO START WB)		
		W @ MID (LBS)	0	0	0	(FT.)		
		PL 1 (LBS)	0	0	0	0.0		
		PL 2 (LBS)	0	0	0	0.0		
		PL 3 (LBS)	0	0	0	0.0		
<u>ADJUSTMENT FACTORS</u>								
CD	1.60							
CM*CT*CI	0.80							
CL	1.00							
CF*CV	1.00							
CFU*CR	1.00							

RESULTSBEAM DESCRIPTION 1 6" x 6" HF #1BEAM PROPERTIES

SX (IN ³)	31.68
AREA (IN ²)	33.06
IX (IN ⁴)	91
E' (PSI)	1300000
F' B (PSI)	1248
F' V (PSI)	179

REQ'D PROPERTIES

Sx (IN ³)	15.07
AREA (IN ²)	2.69

PROPERTIES ADEQUATE*?

YES
YES

CALC'D LOADS & STRESSES

MAX MOMENT (LB*FT)	1,567
REACTION L (LBS)	482
REACTION R (LBS)	482

MAX. DEFLECTION

LL (IN.)	1.30
TL (IN.)	1.30

CALC'D DEFLECTION

LL (IN.)	0.40
TL (IN.)	0.40

YES
YES

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BEAM

GABLE COL

INPUT

<u>BEAM PARAMETERS</u>		<u>LOADING</u>		LL	DL	LOAD DIST.	<u>DEFLECTION LIMITS</u>	
BEAM TABLE NO.	185	W (PLF)	74.20	0	0	FROM LEFT	LL, L/	120
QUANTITY	1	W FROM LEFT (LBS)	0	0	0	WA, RIGHT WC,	TL, L/	120
SPAN (FT)	13.0	W FROM RIGHT (LBS)	0	0	0	TO START WB)		
		W @ MID (LBS)	0	0	0	(FT.)		
		PL 1 (LBS)	0	0	0	0.0		
		PL 2 (LBS)	0	0	0	0.0		
		PL 3 (LBS)	0	0	0	0.0		
<u>ADJUSTMENT FACTORS</u>								
CD	1.60							
CM*CT*CI	1.00							
CL	1.00							
CF*CV	1.00							
CFU*CR	1.00							

RESULTSBEAM DESCRIPTION 1 4-PLY 2X6BEAM PROPERTIES

SX (IN ³)	21.67
AREA (IN ²)	24.19
IX (IN ⁴)	58
E' (PSI)	1550000
F' B (PSI)	2160
F' V (PSI)	216

REQ'D PROPERTIES

Sx (IN ³)	8.71
AREA (IN ²)	2.23

PROPERTIES ADEQUATE*?

YES
YES

CALC'D LOADS & STRESSES

MAX MOMENT (LB*FT)	1,567
REACTION L (LBS)	482
REACTION R (LBS)	482

MAX. DEFLECTION

LL (IN.)	1.30
TL (IN.)	1.30

CALC'D DEFLECTION

LL (IN.)	0.40
TL (IN.)	0.40

YES
YES

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**Post Calculations W/ Bending
 2015 NDS**

Input	Results	COLUMN
BEARING POST		
Axial		
Fc= 1500.00 psi		
Cd= 1.15		
Cm= 1.00	F'c= 1380.00 psi	
Ct= 1.00	(Cd*Cm*Ct*Cf*Ci*Cp)	
CF= 1.00 (built up col)		
Ci= 0.80	Cp= 0.49	
	((1+(Fce/Fc))/(2*C) - (((1+(Fce/Fc))/(2*C))^2 - ((Fce/Fc)/c))^0.5	
load= 4,158 lbs		
Area= 33.0625 in2	Fce= 805 psi	
	(Kce*E')/(Le/d)^2	
Kce= 0.30		
E'= 1,600,000 psi	676 psi	
L= 156.0 in	126 psi	
K= 0.9 in		
Le= 140.4 in	check OK	
d= 5.75 in		
b= 5.75 in		
c= 0.80	F'b= 1248	
	763	
Bending		
Fb= 975.00 psi	tress Ratio 0.76	
CD= 1.60	check OK	
CL= 1.00		
Cv= 1.00		
Cfu= 1.00		
Cr= 1.00		
Ci= 0.80		
	1.00	
load= 95 plf		
Sx= 31.7 in3		

Provide 1 6x6 HF#1 Treated
 Maximum Height: 13.0 ft
 Weak Axis Braced at 2.0 ft

PROJECT: Roper Nelson Garilyn West Weber
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**Post Calculations W/ Bending
 2015 NDS**

Input	Results	COLUMN
BEARING POST		
Axial		
Fc= 1500.00 psi		
Cd= 1.15		
Cm= 1.00	F'c= 1725.00 psi	
Ct= 1.00	(Cd*Cm*Ct*Cf*Ci*Cp)	
CF= 1.00 (built up col)		
Ci= 1.00	Cp= 0.42	
	((1+(Fce/Fc))/(2*C) - (((1+(Fce/Fc))/(2*C))^2 - ((Fce/Fc)/c))^.5	
load= 4,158 lbs		
Area= 32.25 in2	Fce= 826 psi	
	(Kce*E')/(Le/d)^2	
Kce= 0.30		
E'= 1,600,000 psi	722 psi	
L= 144.0 in	129 psi	
K= 0.9 in		
Le= 129.6 in	check OK	
d= 5.38 in		
b= 6.00 in		
c= 0.80	F'b= 907	
	713	
Bending		
Fb= 567.00 psi	tress Ratio 0.96	
CD= 1.60	check OK	
CL= 1.00		
Cv= 1.00		
Cfu= 1.00		
Cr= 1.00		
Ci= 1.00		
load= 95 plf		
Sx= 28.9 in3		

Provide 1 (4) Ply 2x6
 Maximum Height: 12.0 ft
 Weak Axis Braced at 2.0 ft

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BEAM #1, Roof Purlins**Input**Beam Parameters

Beam table no.	2
Quantity	1
Span (ft)	11.5

Adjustment factors

CD	1.15
CM*Ct*Ci	1.00
CL	1.00
CF*CV	1.30
Cfu*Cr	1.15

Loading

	LL	DL	Load Dist.
w (plf)	74	6	from left wa,
W from left (lbs)	0	0	right wc, to
W from right (lbs)	0	0	start wb) (ft.)
W @ mid (lbs)	0	0	
PL 1 (lbs)	0	0	0.0
PL 2 (lbs)	0	0	0.0
PL 3 (lbs)	0	0	0.0

Deflection Limits

LL, L/	240
TL, L/	180

ResultsBeam Description

1 2" x 6" HF#2 Lapped

Beam Properties

SX (in3)	7.56
Area (in2)	8.25
IX (in4)	21
E' (psi)	1690000
F' b (psi)	2192
F' v (psi)	173

Req'd Properties

Sx (in3)	7.24
Area (in2)	2.67

Properties Adequate*?

Yes
Yes

Calc'd Loads & Stresses

Max Moment (lb*ft)	1,323
Reaction L (lbs)	460
Reaction R (lbs)	460

Max. Deflection

LL (in.)	0.58
TL (in.)	0.77

Calc'd Deflection

LL (in.)	0.83
TL (in.)	0.90

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2x6 HF Wall Girts @ 24" o.c.

Walls are Considered Flexiblable for Deflection Calc Criteria

BEAM 2x6 Wall Girts

Input

<u>Beam Parameters</u>		<u>Loading</u>	LL	DL	Load Dist.	<u>Deflection Limits</u>	
Beam table no.	2	w (plf)	17.52	0	from left wa,	LL, L/	120
Quantity	1	W from left (lbs)	0	0	right wc, to	TL, L/	120
Span (ft)	11.5	W from right (lbs)	0	0	start wb) (ft.)		
		W @ mid (lbs)	0	0			
<u>Adjustment factors</u>		PL 1 (lbs)	0	0	0.0		
CD	1.60	PL 2 (lbs)	0	0	0.0		
CM*Ct*Ci	1.00	PL 3 (lbs)	0	0	0.0		
CL	1.00						
CF*CV	1.30						
Cfu*Cr	1.32	W/ Metal Siding					

Results

Beam Description 1 2" x 6" HF#2 Flat

<u>Beam Properties</u>		<u>Req'd Properties</u>		<u>Properties Adequate*?</u>
SX (in3)	2.06	Sx (in3)	1.49	Yes
Area (in2)	8.25	Area (in2)	0.42	Yes
IX (in4)	2			
E' (psi)	1690000	<u>Calc'd Loads & Stresses</u>		
F' b (psi)	2338	Max Moment (lb*ft)	290	
F' v (psi)	240	Reaction L (lbs)	101	
		Reaction R (lbs)	101	
<u>Max. Deflection</u>		<u>Calc'd Deflection</u>		
LL (in.)	1.15	LL (in.)	2.65	
TL (in.)	1.15	TL (in.)	2.65	

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BEAM Rafter Beam

Input

Beam Parameters

Beam table no.	10
Quantity	1
Span (ft)	12.0

Adjustment factors

CD	1.00
CM*Ci*Ci	1.00
CL	1.00
CF*CV	1.00
Cfu*Cr	1.00

Loading

	LL	DL	
w (plf)	222	18	Load Dist.
W from left (lbs)	0	0	from left wa,
W from right (lbs)	0	0	right wc, to
W @ mid (lbs)	0	0	start wb) (ft.)
PL 1 (lbs)	0	0	0.0
PL 2 (lbs)	0	0	0.0
PL 3 (lbs)	0	0	0.0

Deflection Limits

LL, L/	240
TL, L/	240

Results

Beam Description 1 1-3/4" x 9-1/2" 1.9E Microllam LVL

Beam Properties

SX (in3)	26.32
Area (in2)	16.63
IX (in4)	125
E' (psi)	1900000
F' b (psi)	2600
F' v (psi)	285

Req'd Properties

Sx (in3)	19.94
Area (in2)	5.05

Properties Adequate*?

Yes
Yes

Calc'd Loads & Stresses

Max Moment (lb*ft)	4,320
Reaction L (lbs)	1,440
Reaction R (lbs)	1,440

Max. Deflection

LL (in.)	0.60
TL (in.)	0.60

Calc'd Deflection

LL (in.)	0.44
TL (in.)	0.47

Yes
Yes