



# GREEN ENGINEERING CONSULTING ENGINEERS

852 W. Sexton Rd., Sebastopol, CA 95472  
phone 707 824 0660 fax 707 824 0567  
www.greenengineering.net

TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	1 of 58

*JMA Architects*

*California Building Code - 2007 Edition*

### Lateral Loads-

Wind: ASCE 7 [6.4.2.1] Simplified Method CBC 2007 [1605A.3.2]  $w=1.3$

Seismic = Simplified Method CBC 2007 [12.14.8] Seismic Design Category E [1613A.5.6]  
R=3.5 (Ordinary MF) Ss=1.5 [12.8.1.3] F=1.1 [12.14.8.1]

$$V=(F S_d s / R) W = .44W$$

### Vertical Loads

	<u>Dead</u>	<u>Live</u>
Roof (Hip 3:12 )	14 psf	20 psf
Roof (Flat .25:12 )	14 psf	20 psf
Floor (carpet)	10 psf	40 psf
Ext. Deck (tile)	35 psf	50 psf * Incl .2" ponding
Exterior Walls (siding )	15 psf	-----
Interior Walls (gyp brd)	10 psf	-----

### Foundation Design

Spread Footing Foundation

12" and 15" wide ; 18" into finished grade or 18" below existing grade  
Bearing Pressures - 1500psf (DL), 1500psf (DL+LL), 1500psf (total)





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Footing Design [ 2006 International Building Code (05 NDS) ] Ver: 7.01.12 By: Todd Green P.E., Green Engineering on: 09-16-2009 : 08:47:26 AM			
Project: WILLIAMS - Location: (N) PAD @ DECK GIRDER SUPPORT POST			
Summary:			
Footing Size: 2.0 FT x 2.0 FT x 12.00 IN Reinforcement: #4 Bars @ 8.00 IN. O.C. E/W / (3) min.			
Footing Loads:			
Live Load:	PL=	3300	LB
Dead Load:	PD=	2000	LB
Total Load:	PT=	5300	LB
Ultimate Factored Load:	Pu=	7680	LB
Footing Properties:			
Allowable Soil Bearing Pressure:	Qs=	1500	PSF
Concrete Compressive Strength:	F'c=	2500	PSI
Reinforcing Steel Yield Strength:	Fy=	60000	PSI
Concrete Reinforcement Cover:	c=	3.00	IN
Footing Size:			
Width:	W=	2.0	FT
Length:	L=	2.0	FT
Depth:	Depth=	12.00	IN
Effective Depth to Top Layer of Steel:	d=	8.25	IN
Column and Baseplate Size:			
Column Type:		(Steel)	
Column Width:	m=	6.00	IN
Column Depth:	n=	4.00	IN
Baseplate Width:	bsw=	6.00	IN
Baseplate Length:	bsl=	4.00	IN
Bearing Calculations:			
Ultimate Bearing Pressure:	Qu=	1325	PSF
Effective Allowable Soil Bearing Pressure:	Qe=	1350	PSF
Required Footing Area:	Areq=	3.93	SF
Area Provided:	A=	4.0	SF
Baseplate Bearing:			
Bearing Required:	Bearing=	7680	LB
Allowable Bearing:	Bearing-Allow=	71400	LB
Beam Shear Calculations (One Way Shear):			
Beam Shear:	Vu1=	560	LB
Allowable Beam Shear:	vc1=	16830	LB
Punching Shear Calculations (Two way shear):			
Critical Perimeter:	Bo=	53.00	IN
Punching Shear:	Vu2=	5353	LB
Allowable Punching Shear (ACI 11-35):	vc2-a=	86721	LB
Allowable Punching Shear (ACI 11-36):	vc2-b=	152873	LB
Allowable Punching Shear (ACI 11-37):	vc2-c=	74333	LB
Controlling Allowable Punching Shear:	vc2=	74333	LB
Bending Calculations:			
Factored Moment:	Mu=	16000	IN-LB
Nominal Moment Strength:	Mn=	251278	IN-LB
Reinforcement Calculations:			
Concrete Compressive Block Depth:	a=	0.69	IN
Steel Required Based on Moment:	As(1)=	0.04	IN2
Minimum Code Required Reinforcement (Shrinkage/Temperature ACI-10.5.4):	As(2)=	0.52	IN2
Controlling Reinforcing Steel:	As-reqd=	0.52	IN2
Selected Reinforcement:		#4 Bars @ 8.00 IN. O.C. E/W / (3) Min.	
Reinforcement Area Provided:	As=	0.59	IN2
Development Length Calculations:			
Development Length Required:	Ld=	15.00	IN
Development Length Supplied:	Ld-sup=	7.00	IN
Note: Plain concrete adequate for bending, therefore adequate development length not required.			



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TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	3 of 58

Uniformly Loaded Floor Beam [ 2006 International Building Code (05 NDS) ] Ver: 7.01.12  
 By: Todd Green P.E. , Green Engineering on: 09-16-2009 : 08:47:27 AM

Project: WILLIAMS - Location: (N) DECK RIM

Summary:

1.75 IN x 9.5 IN x 8.0 FT / 1.9E Microllam - iLevel Trus Joist  
 Section Adequate By: 149.8% Controlling Factor: Moment of Inertia / Depth Required 7.0 In

Deflections:

Dead Load:	DLD=	0.07	IN
Live Load:	LLD=	0.04	IN = L/2475
Total Load:	TLD=	0.11	IN = L/899

Reactions (Each End):

Live Load:	LL-Rxn=	400	LB
Dead Load:	DL-Rxn=	701	LB
Total Load:	TL-Rxn=	1101	LB
Bearing Length Required (Beam only, support capacity not checked):	BL=	0.84	IN

Beam Data:

Span:	L=	8.0	FT
Unbraced Length-Top of Beam:	Lu=	0.0	FT
Live Load Deflect. Criteria:	L/	480	
Total Load Deflect. Criteria:	L/	360	

Floor Loading:

Floor Live Load-Side One:	LL1=	50.0	PSF
Floor Dead Load-Side One:	DL1=	35.0	PSF
Tributary Width-Side One:	TW1=	2.0	FT
Floor Live Load-Side Two:	LL2=	50.0	PSF
Floor Dead Load-Side Two:	DL2=	35.0	PSF
Tributary Width-Side Two:	TW2=	0.0	FT
Live Load Duration Factor:	Cd=	1.00	
Wall Load:	WALL=	100	PLF

Beam Loading:

Beam Total Live Load:	wL=	100	PLF
Beam Self Weight:	BSW=	5	PLF
Beam Total Dead Load:	wD=	175	PLF
Total Maximum Load:	wT=	275	PLF

Properties For: 1.9E Microllam - iLevel Trus Joist

Bending Stress:	Fb=	2600	PSI
Shear Stress:	Fv=	285	PSI
Modulus of Elasticity:	E=	1900000	PSI
Stress Perpendicular to Grain:	Fc_perp=	750	PSI

Adjusted Properties

Fb' (Tension):	Fb'=	2684	PSI
Adjustment Factors: Cd=1.00 CF=1.03			
Fv':	Fv'=	285	PSI
Adjustment Factors: Cd=1.00			

Design Requirements:

Controlling Moment:	M=	2202	FT-LB
4.0 ft from left support			
Critical moment created by combining all dead and live loads.			
Controlling Shear:	V=	903	LB
At a distance d from support.			
Critical shear created by combining all dead and live loads.			

Comparisons With Required Sections:

Section Modulus (Moment):	Sreq=	9.84	IN3
	S=	26.32	IN3
Area (Shear):	Areq=	4.75	IN2
	A=	16.63	IN2
Moment of Inertia (Deflection):	Ireq=	50.05	IN4
	I=	125.03	IN4



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Uniformly Loaded Floor Beam [ AISC 9th Ed ASD ] Ver: 7.01.12			
By: Todd Green P.E., Green Engineering on: 09-16-2009 : 08:47:30 AM			
Project: WILLIAMS - Location: MAIN DECK GIRDER (STL ALT.)			
Summary:			
A992-50 W10x30 x 21.5 FT			
Section Adequate By: 38.0% Controlling Factor: Moment of Inertia			
Deflections:			
Dead Load:	DLD=	0.20	IN
Live Load:	LLD=	0.32	IN = L/802
Total Load:	TLD=	0.52	IN = L/497
Reactions (Each End):			
Live Load:	LL-Rxn=	3548	LB
Dead Load:	DL-Rxn=	2177	LB
Total Load:	TL-Rxn=	5724	LB
Bearing Length Required (Beam only, support capacity not checked):	BL=	0.81	IN
Beam Data:			
Span:	L=	21.5	FT
Unbraced Length-Top of Beam:	Lu=	0.0	FT
Live Load Deflect. Criteria:	L/	480	
Total Load Deflect. Criteria:	L/	360	
Floor Loading:			
Floor Live Load-Side One:	LL1=	50.0	PSF
Floor Dead Load-Side One:	DL1=	35.0	PSF
Tributary Width-Side One:	TW1=	3.0	FT
Floor Live Load-Side Two:	LL2=	40.0	PSF
Floor Dead Load-Side Two:	DL2=	15.0	PSF
Tributary Width-Side Two:	TW2=	4.5	FT
Wall Load:	WALL=	0	PLF
Beam Loading:			
Beam Total Live Load:	wL=	330	PLF
Beam Self Weight:	BSW=	30	PLF
Beam Total Dead Load:	wD=	203	PLF
Total Maximum Load:	wT=	533	PLF
Properties for: W10x30/A992-50			
Yield Stress:	Fy=	50	KSI
Modulus of Elasticity:	E=	29000	KSI
Depth:	d=	10.50	IN
Web Thickness:	tw=	0.30	IN
Flange Width:	bf=	5.81	IN
Flange Thickness:	tf=	0.51	IN
Distance to Web Toe of Fillet:	k=	0.81	IN
Moment of Inertia About X-X Axis:	Ix=	170.00	IN4
Section Modulus About X-X Axis:	Sx=	32.40	IN3
Radius of Gyration of Compression Flange + 1/3 of Web:	rt=	1.56	IN
Design Properties per AISC Steel Construction Manual:			
Flange Buckling Ratio:	FBR=	5.70	
Allowable Flange Buckling Ratio:	AFBR=	9.19	
Web Buckling Ratio:	WBR=	35.00	
Allowable Web Buckling Ratio:	AWBR=	90.51	
Controlling Unbraced Length:	Lb=	0.0	FT
Limiting Unbraced Length for Fb=.66*Fy:	Lc=	5.2	FT
Allowable Bending Stress:	Fb=	33.0	KSI
Web Height to Thickness Ratio:	h/tw=	31.6	
Limiting Web Height to Thickness Ratio for Fv=.4*Fy:	h/tw-Limit=	53.74	
Allowable Shear Stress:	Fv=	20.0	KSI
Design Requirements Comparison:			
Controlling Moment:	M=	30769	FT-LB
Nominal Moment Strength:	Mr=	89100	FT-LB
Controlling Shear:	V=	5724	LB
Nominal Shear Strength:	Vr=	63000	LB
Moment of Inertia (Deflection):	Ireq=	123.16	IN4
	I=	170.00	IN4



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Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	5 of 58

Uniformly Loaded Floor Beam   2006 International Building Code (05 NDS)   Ver: 7.01.12			
By: Todd Green P.E., Green Engineering on: 09-16-2009 : 08:47:31 AM			
Project: WILLIAMS - Location: MAIN DECK GIRDER			
Summary:			
5.125 IN x 18.0 IN x 21.5 FT / 20F-V12 - Visually Graded Western Species - Dry Use			
Section Adequate By: 6.6% Controlling Factor: Moment of Inertia / Depth Required 17.62 IN			
Deflections:			
Dead Load:	DLD=	0.25	IN
Live Load:	LLD=	0.42	IN = L/608
Total Load:	TLD=	0.67	IN = L/384
Reactions (Each End):			
Live Load:	LL-Rxn=	3548	LB
Dead Load:	DL-Rxn=	2069	LB
Total Load:	TL-Rxn=	5617	LB
Bearing Length Required (Beam only, support capacity not checked):	BL=	1.96	IN
Camber Req'd.:	C=	0.37	IN
Beam Data:			
Span:	L=	21.5	FT
Unbraced Length-Top of Beam:	Lu=	0.0	FT
Live Load Deflect. Criteria:	L/	480	
Total Load Deflect. Criteria:	L/	360	
Camber Adjustment Factor:	CAF=	1.5	X DLD
Floor Loading:			
Floor Live Load-Side One:	LL1=	50.0	PSF
Floor Dead Load-Side One:	DL1=	35.0	PSF
Tributary Width-Side One:	TW1=	3.0	FT
Floor Live Load-Side Two:	LL2=	40.0	PSF
Floor Dead Load-Side Two:	DL2=	15.0	PSF
Tributary Width-Side Two:	TW2=	4.5	FT
Live Load Duration Factor:	Cd=	1.00	
Wall Load:	WALL=	0	PLF
Beam Loading:			
Beam Total Live Load:	wL=	330	PLF
Beam Self Weight:	BSW=	20	PLF
Beam Total Dead Load:	wD=	192	PLF
Total Maximum Load:	wT=	522	PLF
Properties For: 20F-V12- Visually Graded Western Species			
Bending Stress:	Fb=	2000	PSI
Shear Stress:	Fv=	265	PSI
Modulus of Elasticity:	E=	1500000	PSI
Adjusted Modulus of Elasticity:	E-Min=	780000	PSI
Stress Perpendicular to Grain:	Fc perp=	560	PSI
Bending Stress of Comp. Face in Tension:	Fb_cpr=	1400	PSI
Adjusted Properties			
Fb' (Tension):	Fb'=	1916	PSI
Adjustment Factors: Cd=1.00 Cv=0.96			
Fv':	Fv'=	265	PSI
Adjustment Factors: Cd=1.00			
Design Requirements:			
Controlling Moment:	M=	30191	FT-LB
10.75 ft from left support			
Critical moment created by combining all dead and live loads.			
Controlling Shear:	V=	4943	LB
At a distance d from support.			
Critical shear created by combining all dead and live loads.			
Comparisons With Required Sections:			
Section Modulus (Moment):	Sreq=	189.08	IN3
	S=	276.75	IN3
Area (Shear):	Areq=	27.98	IN2
	A=	92.25	IN2
Moment of Inertia (Deflection):	Ireq=	2336.37	IN4
	I=	2490.75	IN4



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Uniformly Loaded Floor Beam [ AISC 9th Ed ASD ] Ver: 7.01.12			
By: Todd Green P.E., Green Engineering on: 09-16-2009 : 08:47:35 AM			
Project: WILLIAMS - Location: MAIN GIRDER IN GARAGE (STL ALT.)			
Summary:			
A992-50 W10x30 x 21.0 FT			
Section Adequate By: 14.3% Controlling Factor: Moment of Inertia			
Deflections:			
Dead Load:	DLD=	0.19	IN
Live Load:	LLD=	0.43	IN = L/592
Total Load:	TLD=	0.61	IN = L/412
Reactions (Each End):			
Live Load:	LL-Rxn=	5040	LB
Dead Load:	DL-Rxn=	2205	LB
Total Load:	TL-Rxn=	7245	LB
Bearing Length Required (Beam only, support capacity not checked):			
	BL=	0.81	IN
Beam Data:			
Span:	L=	21.0	FT
Unbraced Length-Top of Beam:	Lu=	0.0	FT
Live Load Deflect. Criteria:	L/	480	
Total Load Deflect. Criteria:	L/	360	
Floor Loading:			
Floor Live Load-Side One:	LL1=	40.0	PSF
Floor Dead Load-Side One:	DL1=	15.0	PSF
Tributary Width-Side One:	TW1=	6.0	FT
Floor Live Load-Side Two:	LL2=	40.0	PSF
Floor Dead Load-Side Two:	DL2=	15.0	PSF
Tributary Width-Side Two:	TW2=	6.0	FT
Wall Load:	WALL=	0	PLF
Beam Loading:			
Beam Total Live Load:	wL=	480	PLF
Beam Self Weight:	BSW=	30	PLF
Beam Total Dead Load:	wD=	210	PLF
Total Maximum Load:	wT=	690	PLF
Properties for: W10x30/A992-50			
Yield Stress:	Fy=	50	KSI
Modulus of Elasticity:	E=	29000	KSI
Depth:	d=	10.50	IN
Web Thickness:	tw=	0.30	IN
Flange Width:	bf=	5.81	IN
Flange Thickness:	tf=	0.51	IN
Distance to Web Toe of Fillet:	k=	0.81	IN
Moment of Inertia About X-X Axis:	Ix=	170.00	IN4
Section Modulus About X-X Axis:	Sx=	32.40	IN3
Radius of Gyration of Compression Flange + 1/3 of Web:	rt=	1.56	IN
Design Properties per AISC Steel Construction Manual:			
Flange Buckling Ratio:	FBR=	5.70	
Allowable Flange Buckling Ratio:	AFBR=	9.19	
Web Buckling Ratio:	WBR=	35.00	
Allowable Web Buckling Ratio:	AWBR=	90.51	
Controlling Unbraced Length:	Lb=	0.0	FT
Limiting Unbraced Length for Fb=.66*Fy:	Lc=	5.2	FT
Allowable Bending Stress:	Fb=	33.0	KSI
Web Height to Thickness Ratio:	h/tw=	31.6	
Limiting Web Height to Thickness Ratio for Fv=.4*Fy:	h/tw-Limit=	53.74	
Allowable Shear Stress:	Fv=	20.0	KSI
Design Requirements Comparison:			
Controlling Moment:	M=	38036	FT-LB
Nominal Moment Strength:	Mr=	89100	FT-LB
Controlling Shear:	V=	7245	LB
Nominal Shear Strength:	Vr=	63000	LB
Moment of Inertia (Deflection):	Ireq=	148.71	IN4
	I=	170.00	IN4



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Uniformly Loaded Floor Beam [ 2006 International Building Code (05 NDS) ] Ver: 7.01.12

By: Todd Green P.E. , Green Engineering on: 09-16-2009 : 08:47:36 AM

Project: WILLIAMS - Location: MAIN GIRDER IN GARAGE

Summary:

5.125 IN x 18.0 IN x 21.0 FT / 24F-V4 - Visually Graded Western Species - Dry Use  
 Section Adequate By: 5.5% Controlling Factor: Moment of Inertia / Depth Required 17.68 In

Deflections:

Dead Load:	DLD=	0.20	IN
Live Load:	LLD=	0.47	IN = L/538
Total Load:	TLD=	0.66	IN = L/380

Reactions (Each End):

Live Load:	LL-Rxn=	5040	LB
Dead Load:	DL-Rxn=	2100	LB
Total Load:	TL-Rxn=	7140	LB
Bearing Length Required (Beam only, support capacity not checked):	BL=	2.14	IN
Camber Req'd.:	C=	0.29	IN

Beam Data:

Span:	L=	21.0	FT
Unbraced Length-Top of Beam:	Lu=	0.0	FT
Live Load Deflect. Criteria:	L/	480	
Total Load Deflect. Criteria:	L/	360	
Camber Adjustment Factor:	CAF=	1.5	X DLD

Floor Loading:

Floor Live Load-Side One:	LL1=	40.0	PSF
Floor Dead Load-Side One:	DL1=	15.0	PSF
Tributary Width-Side One:	TW1=	6.0	FT
Floor Live Load-Side Two:	LL2=	40.0	PSF
Floor Dead Load-Side Two:	DL2=	15.0	PSF
Tributary Width-Side Two:	TW2=	6.0	FT
Live Load Duration Factor:	Cd=	1.00	
Wall Load:	WALL=	0	PLF

Beam Loading:

Beam Total Live Load:	wL=	480	PLF
Beam Self Weight:	BSW=	20	PLF
Beam Total Dead Load:	wD=	200	PLF
Total Maximum Load:	wT=	680	PLF

Properties For: 24F-V4- Visually Graded Western Species

Bending Stress:	Fb=	2400	PSI
Shear Stress:	Fv=	265	PSI
Modulus of Elasticity:	E=	1800000	PSI
Adjusted Modulus of Elasticity:	E-Min=	930000	PSI
Stress Perpendicular to Grain:	Fc perp=	650	PSI
Bending Stress of Comp. Face in Tension:	Fb_cpr=	1850	PSI

Adjusted Properties

Fb' (Tension):	Fb'=	2305	PSI
Adjustment Factors: Cd=1.00 Cv=0.96			
Fv':	Fv'=	265	PSI
Adjustment Factors: Cd=1.00			

Design Requirements:

Controlling Moment:	M=	37485	FT-LB
10.5 ft from left support			
Critical moment created by combining all dead and live loads.			
Controlling Shear:	V=	6140	LB
At a distance d from support.			
Critical shear created by combining all dead and live loads.			

Comparisons With Required Sections:

Section Modulus (Moment):	Sreq=	195.18	IN3
	S=	276.75	IN3
Area (Shear):	Areq=	34.76	IN2
	A=	92.25	IN2
Moment of Inertia (Deflection):	Ireq=	2361.17	IN4
	I=	2490.75	IN4



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Roof Beam [ 2006 International Building Code (05 NDS) ] Ver: 7.01.12 By: Todd Green P.E. , Green Engineering on: 09-16-2009 : 08:47:38 AM		
Project: WILLIAMS - Location: (N) HEADER @ STAIRWAY		
Summary: 3.5 IN x 7.25 IN x 7.0 FT / #1 - Douglas-Fir-Larch (North) - Dry Use Section Adequate By: 24.3% Controlling Factor: Section Modulus / Depth Required 6.5 In		
Deflections:		
Dead Load:	DLD=	0.07 IN
Live Load:	LLD=	0.07 IN = L/1152
Total Load:	TLD=	0.14 IN = L/597
Reactions (Each End):		
Live Load:	LL-Rxn=	840 LB
Dead Load:	DL-Rxn=	782 LB
Total Load:	TL-Rxn=	1622 LB
Bearing Length Required (Beam only, support capacity not checked):	BL=	0.74 IN
Beam Data:		
Span:	L=	7.0 FT
Maximum Unbraced Span:	Lu=	0.0 FT
Pitch Of Roof:	RP=	0. : 12
Live Load Deflect. Criteria:	L/	360
Total Load Deflect. Criteria:	L/	240
Roof Loading:		
Roof Live Load-Side One:	LL1=	20.0 PSF
Roof Dead Load-Side One:	DL1=	14.0 PSF
Tributary Width-Side One:	TW1=	10.0 FT
Roof Live Load-Side Two:	LL2=	20.0 PSF
Roof Dead Load-Side Two:	DL2=	14.0 PSF
Tributary Width-Side Two:	TW2=	2.0 FT
Roof Duration Factor:	Cd=	1.25
Wall Load:	WALL=	50 PLF
Beam Self Weight:	BSW=	5 PLF
Slope/Pitch Adjusted Lengths and Loads:		
Adjusted Beam Length:	Ladj=	7.0 FT
Beam Uniform Live Load:	wL=	240 PLF
Beam Uniform Dead Load:	wD_adj=	223 PLF
Total Uniform Load:	wT=	463 PLF
Properties For: #1- Douglas-Fir-Larch (North)		
Bending Stress:	Fb=	850 PSI
Shear Stress:	Fv=	180 PSI
Modulus of Elasticity:	E=	1600000 PSI
Adjusted Modulus of Elasticity:	E-Min=	580000 PSI
Stress Perpendicular to Grain:	Fc_perp=	625 PSI
Adjusted Properties		
Fb' (Tension):	Fb'=	1381 PSI
Adjustment Factors: Cd=1.25 CF=1.30		
Fv':	Fv'=	225 PSI
Adjustment Factors: Cd=1.25		
Design Requirements:		
Controlling Moment:	M=	2838 FT-LB
3.5 ft from left support		
Critical moment created by combining all dead and live loads.		
Controlling Shear:	V=	1362 LB
At a distance d from support.		
Critical shear created by combining all dead and live loads.		
Comparisons With Required Sections:		
Section Modulus (Moment):	Sreq=	24.66 IN3
	S=	30.66 IN3
Area (Shear):	Areq=	9.08 IN2
	A=	25.38 IN2
Moment of Inertia (Deflection):	Ireq=	44.70 IN4
	I=	111.15 IN4



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TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	9 of 58

Roof Beam [ 2006 International Building Code (05 NDS)   Ver: 7.01.12 By: Todd Green P.E., Green Engineering on: 09-16-2009 : 08:47:39 AM			
Project: WILLIAMS - Location: ARCHED OPENING HEADOUT BEAMS (TYP. OF 2)			
Summary: 3.5 IN x 9.5 IN x 15.0 FT / 1.9E Microllam - iLevel Trus Joist Section Adequate By: 111.3% Controlling Factor: Moment of Inertia / Depth Required 7.4 In			
Deflections:		DLD=	0.16 IN
Dead Load:		LLD=	0.19 IN = L/939
Live Load:		TLD=	0.36 IN = L/507
Total Load:			
Reactions (Each End):		LL-Rxn=	600 LB
Live Load:		DL-Rxn=	511 LB
Dead Load:		TL-Rxn=	1111 LB
Total Load:		BL=	0.42 IN
Bearing Length Required (Beam only, support capacity not checked):			
Beam Data:			
Span:		L=	15.0 FT
Maximum Unbraced Span:		Lu=	0.0 FT
Pitch Of Roof:		RP=	3. : 12
Live Load Deflect. Criteria:		L/	360
Total Load Deflect. Criteria:		L/	240
Non-Snow Live Load:			
Roof Loaded Area:		RLA=	60.0 SF
Roof Loading:			
Roof Live Load-Side One:		LL1=	20.0 PSF
Roof Dead Load-Side One:		DL1=	14.0 PSF
Tributary Width-Side One:		TW1=	2.0 FT
Roof Live Load-Side Two:		LL2=	20.0 PSF
Roof Dead Load-Side Two:		DL2=	14.0 PSF
Tributary Width-Side Two:		TW2=	2.0 FT
Roof Duration Factor:		Cd=	1.25
Beam Self Weight:		BSW=	10 PLF
Slope/Pitch Adjusted Lengths and Loads:			
Adjusted Beam Length:		Ladj=	15.0 FT
Beam Uniform Live Load:		wL=	80 PLF
Beam Uniform Dead Load:		wD_adj=	68 PLF
Total Uniform Load:		wT=	148 PLF
Properties For: 1.9E Microllam- iLevel Trus Joist			
Bending Stress:		Fb=	2600 PSI
Shear Stress:		Fv=	285 PSI
Modulus of Elasticity:		E=	19000000 PSI
Stress Perpendicular to Grain:		Fc_perp=	750 PSI
Adjusted Properties			
Fb' (Tension):		Fb'=	3355 PSI
Adjustment Factors: Cd=1.25 CF=1.03			
Fv':		Fv'=	356 PSI
Adjustment Factors: Cd=1.25			
Design Requirements:			
Controlling Moment:		M=	4166 FT-LB
7.5 ft from left support			
Critical moment created by combining all dead and live loads.			
Controlling Shear:		V=	1000 LB
At a distance d from support.			
Critical shear created by combining all dead and live loads.			
Comparisons With Required Sections:			
Section Modulus (Moment):		Sreq=	14.90 IN3
		S=	52.65 IN3
Area (Shear):		Areq=	4.21 IN2
		A=	33.25 IN2
Moment of Inertia (Deflection):		Ireq=	118.37 IN4
		I=	250.07 IN4



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TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	10 of 58

Roof Beam [ 2006 International Building Code (05 NDS) ] Ver: 7.01.12 By: Todd Green P.E., Green Engineering on: 09-16-2009 : 08:47:41 AM			
Project: WILLIAMS - Location: GLB @ FAMILY			
Summary:			
5.125 IN x 24.0 IN x 30.0 FT / 24F-V4 - Visually Graded Western Species - Dry Use			
Section Adequate By: 15.6% Controlling Factor: Moment of Inertia / Depth Required 22.87 In			
Deflections:			
Dead Load:	DLD=	0.61	IN
Live Load:	LLD=	0.69	IN = L/525
Total Load:	TLD=	1.30	IN = L/277
Reactions (Each End):			
Live Load:	LL-Rxn=	6000	LB
Dead Load:	DL-Rxn=	5350	LB
Total Load:	TL-Rxn=	11350	LB
Bearing Length Required (Beam only, support capacity not checked):	BL=	3.41	IN
Camber Req'd.:	C=	0.92	IN
Beam Data:			
Span:	L=	30.0	FT
Maximum Unbraced Span:	Lu=	0.0	FT
Pitch Of Roof:	RP=	0.	: 12
Live Load Deflect. Criteria:	L/	360	
Total Load Deflect. Criteria:	L/	240	
Camber Adjustment Factor:	CAF=	1.5	X DLD
Roof Loading:			
Roof Live Load-Side One:	LL1=	20.0	PSF
Roof Dead Load-Side One:	DL1=	14.0	PSF
Tributary Width-Side One:	TW1=	10.0	FT
Roof Live Load-Side Two:	LL2=	20.0	PSF
Roof Dead Load-Side Two:	DL2=	14.0	PSF
Tributary Width-Side Two:	TW2=	10.0	FT
Roof Duration Factor:	Cd=	1.15	
Wall Load:	WALL=	50	PLF
Beam Self Weight:	BSW=	27	PLF
Slope/Pitch Adjusted Lengths and Loads:			
Adjusted Beam Length:	Ladj=	30.0	FT
Beam Uniform Live Load:	wL=	400	PLF
Beam Uniform Dead Load:	wD_adj=	357	PLF
Total Uniform Load:	wT=	757	PLF
Properties For: 24F-V4- Visually Graded Western Species			
Bending Stress:	Fb=	2400	PSI
Shear Stress:	Fv=	265	PSI
Modulus of Elasticity:	E=	1800000	PSI
Adjusted Modulus of Elasticity:	E-Min=	930000	PSI
Stress Perpendicular to Grain:	Fc perp=	650	PSI
Bending Stress of Comp. Face in Tension:	Fb_cpr=	1850	PSI
Adjusted Properties			
Fb' (Tension):	Fb'=	2485	PSI
Adjustment Factors: Cd=1.15 Cv=0.90			
Fv':	Fv'=	305	PSI
Adjustment Factors: Cd=1.15			
Design Requirements:			
Controlling Moment:	M=	85125	FT-LB
15.0 ft from left support			
Critical moment created by combining all dead and live loads.			
Controlling Shear:	V=	9988	LB
At a distance d from support.			
Critical shear created by combining all dead and live loads.			
Comparisons With Required Sections:			
Section Modulus (Moment):	Sreq=	411.07	IN3
	S=	492.00	IN3
Area (Shear):	Areq=	49.16	IN2
	A=	123.00	IN2
Moment of Inertia (Deflection):	Ireq=	5106.66	IN4
	I=	5904.00	IN4



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TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	11 of 58

Roof Beam [ 2006 International Building Code (05 NDS) ] Ver: 7.01.12 By: Todd Green P.E. , Green Engineering on: 09-16-2009 : 08:47:42 AM		
Project: WILLIAMS - Location: HEADER @ LOFT		
Summary: 3.5 IN x 9.5 IN x 16.0 FT / 1.9E Microllam - iLevel Trus Joist		
Section Adequate By: 225.3% Controlling Factor: Moment of Inertia / Depth Required 6.41 in		
Deflections:		
Dead Load:	DLD=	0.12 IN
Live Load:	LLD=	0.12 IN = L/1547
Total Load:	TLD=	0.25 IN = L/781
Reactions (Each End):		
Live Load:	LL-Rxn=	320 LB
Dead Load:	DL-Rxn=	314 LB
Total Load:	TL-Rxn=	634 LB
Bearing Length Required (Beam only, support capacity not checked):	BL=	0.24 IN
Beam Data:		
Span:	L=	16.0 FT
Maximum Unbraced Span:	Lu=	0.0 FT
Pitch Of Roof:	RP=	3. : 12
Live Load Deflect. Criteria:	L/	360
Total Load Deflect. Criteria:	L/	240
Roof Loading:		
Roof Live Load-Side One:	LL1=	20.0 PSF
Roof Dead Load-Side One:	DL1=	14.0 PSF
Tributary Width-Side One:	TW1=	2.0 FT
Roof Live Load-Side Two:	LL2=	20.0 PSF
Roof Dead Load-Side Two:	DL2=	14.0 PSF
Tributary Width-Side Two:	TW2=	0.0 FT
Roof Duration Factor:	Cd=	1.15
Beam Self Weight:	BSW=	10 PLF
Slope/Pitch Adjusted Lengths and Loads:		
Adjusted Beam Length:	Ladj=	16.0 FT
Beam Uniform Live Load:	wL=	40 PLF
Beam Uniform Dead Load:	wD_adj=	39 PLF
Total Uniform Load:	wT=	79 PLF
Properties For: 1.9E Microllam- iLevel Trus Joist		
Bending Stress:	Fb=	2600 PSI
Shear Stress:	Fv=	285 PSI
Modulus of Elasticity:	E=	1900000 PSI
Stress Perpendicular to Grain:	Fc_perp=	750 PSI
Adjusted Properties		
Fb' (Tension):	Fb'=	3087 PSI
Adjustment Factors: Cd=1.15 CF=1.03		
Fv':	Fv'=	328 PSI
Adjustment Factors: Cd=1.15		
Design Requirements:		
Controlling Moment:	M=	2536 FT-LB
8.0 ft from left support		
Critical moment created by combining all dead and live loads.		
Controlling Shear:	V=	583 LB
At a distance d from support.		
Critical shear created by combining all dead and live loads.		
Comparisons With Required Sections:		
Section Modulus (Moment):	Sreq=	9.86 IN3
	S=	52.65 IN3
Area (Shear):	Areq=	2.67 IN2
	A=	33.25 IN2
Moment of Inertia (Deflection):	Ireq=	76.87 IN4
	I=	250.07 IN4



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<b>TG</b>  <b>Date:</b> 8/4/09	<b>Structural Calculations for:</b> <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	<b>Job #09018</b>  12 of 58
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Multi-Loaded Beam [ 2006 International Building Code (05 NDS) ] Ver: 7.01.12			
By: Todd Green P.E., Green Engineering on: 09-16-2009 : 08:47:44 AM			
Project: WILLIAMS - Location: ARCHED ROOF HEADOUT PICK-UP BEAMS (TYP. OF 2)			
Summary:			
3.5 IN x 9.5 IN x 13.5 FT / 1.9E Microllam - iLevel Trus Joist			
Section Adequate By: 49.6% Controlling Factor: Moment of Inertia / Depth Required 8.31 In			
Center Span Deflections:		DLD-Center=	0.18 IN
Dead Load:		LLD-Center=	0.27 IN = L/603
Live Load:		TLD-Center=	0.45 IN = L/359
Total Load:			
Center Span Left End Reactions (Support A):		LL-Rxn-A=	1456 LB
Live Load:		DL-Rxn-A=	1036 LB
Dead Load:		TL-Rxn-A=	2492 LB
Total Load:		BL-A=	0.95 IN
Bearing Length Required (Beam only, support capacity not checked):			
Center Span Right End Reactions (Support B):		LL-Rxn-B=	1034 LB
Live Load:		DL-Rxn-B=	684 LB
Dead Load:		TL-Rxn-B=	1718 LB
Total Load:		BL-B=	0.65 IN
Bearing Length Required (Beam only, support capacity not checked):			
Beam Data:		L2=	13.5 FT
Center Span Length:		Lu2-Top=	0.0 FT
Center Span Unbraced Length-Top of Beam:		Lu2-Bottom=	13.5 FT
Center Span Unbraced Length-Bottom of Beam:		Cd=	1.25
Live Load Duration Factor:		L/	360
Live Load Deflect. Criteria:		L/	240
Total Load Deflect. Criteria:			
Center Span Loading:			
Uniform Load:		wL-2=	140 PLF
Live Load:		wD-2=	80 PLF
Dead Load:		BSW=	10 PLF
Beam Self Weight:		wT-2=	230 PLF
Total Load:			
Point Load 1		PL1-2=	600 LB
Live Load:		PD1-2=	500 LB
Dead Load:		X1-2=	2.0 FT
Location (From left end of span):			
Properties For: 1.9E Microllam- iLevel Trus Joist		Fb=	2600 PSI
Bending Stress:		Fv=	285 PSI
Shear Stress:		E=	1900000 PSI
Modulus of Elasticity:		Fc_perp=	750 PSI
Stress Perpendicular to Grain:			
Adjusted Properties		Fb'=	3355 PSI
Fb' (Tension):	Adjustment Factors: Cd=1.25 CF=1.03	Fv'=	356 PSI
Fv':	Adjustment Factors: Cd=1.25		
Design Requirements:			
Controlling Moment:	M=	6406	FT-LB
6.075 Ft from left support of span 2 (Center Span)			
Critical moment created by combining all dead loads and live loads on span(s) 2			
Controlling Shear:	V=	2337	LB
At a distance d from left support of span 2 (Center Span)			
Critical shear created by combining all dead loads and live loads on span(s) 2			
Comparisons With Required Sections:			
Section Modulus (Moment):	Sreq=	22.91	IN3
	S=	52.65	IN3
Area (Shear):	Areq=	9.84	IN2
	A=	33.25	IN2
Moment of Inertia (Deflection):	Ireq=	167.13	IN4
	I=	250.07	IN4



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TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	13 of 58

Multi-Loaded Beam [ AISC 9th Ed ASD ] Ver: 7.01.12			
By: Todd Green P.E., Green Engineering on: 09-16-2009 : 08:47:48 AM			
Project: WILLIAMS - Location: DECK OUTRIGGER BEAMS (TYP. OF 2)			
Summary:			
HSS 7 x 5 x 1/4 x 11.5 FT (8 + 3.5) / ASTM A500-GR.B-46			
Section Adequate By: 14.4% Controlling Factor: Moment of Inertia			
Center Span Deflections:		DLD-Center=	-0.01 IN
Dead Load:		LLD-Center=	-0.02 IN = L/4936
Live Load:		TLD-Center=	-0.03 IN = L/3364
Total Load:			
Right Cantilever Deflections:		DLD-Right=	0.04 IN
Dead Load:		LLD-Right=	0.06 IN = L/668
Live Load:		TLD-Right=	0.10 IN = L/412
Total Load:			
Center Span Left End Reactions (Support A):		LL-Rxn-A=	264 LB
Live Load:		DL-Rxn-A=	-9 LB
Dead Load:		TL-Rxn-A=	255 LB
Total Load:		Rxn-A-min=	-366 LB
<b>Design For Uplift Loads (Includes Uplift Factor of Safety)</b>			
Bearing Length Required (Beam only, support capacity not checked):			
Center Span Right End Reactions (Support B):		BL-A=	0.47 IN
Live Load:		LL-Rxn-B=	1552 LB
Dead Load:		DL-Rxn-B=	1255 LB
Total Load:		TL-Rxn-B=	2806 LB
Bearing Length Required (Beam only, support capacity not checked):			
Dead Load Uplift F.S.:		BL-B=	0.47 IN
		FS=	1.0
Beam Data:		L2=	8.0 FT
Center Span Length:		Lu2-Top=	0.0 FT
Center Span Unbraced Length-Top of Beam:		Lu2-Bottom=	8.0 FT
Center Span Unbraced Length-Bottom of Beam:		L3=	3.5 FT
Right Cantilever Length:		Lu3-Top=	0.0 FT
Right Cantilever Unbraced Length-Top of Beam:		Lu3-Bottom=	3.5 FT
Right Cantilever Unbraced Length-Bottom of Beam:		L/	480
Live Load Deflect. Criteria:		L/	360
Total Load Deflect. Criteria:			
Center Span Loading:		wL-2=	66 PLF
Uniform Load:		wD-2=	47 PLF
Live Load:		BSW=	18 PLF
Dead Load:		wT-2=	131 PLF
Beam Self Weight:			
Total Load:			
Right Cantilever Loading:		wL-3=	66 PLF
Uniform Load:		wD-3=	47 PLF
Live Load:		BSW=	18 PLF
Dead Load:		wT-3=	131 PLF
Beam Self Weight:			
Total Load:			
Point Load 1		PL1-3=	700 LB
Live Load:		PD1-3=	500 LB
Dead Load:		X1-3=	3.5 FT
Location (From left end of span):			
Properties for: HSS 7 x 5 x 1/4/A500-GR.B-46		Fy=	46.0 KSI
Steel Yield Strength:		E=	29000 KSI
Modulus of Elasticity:		dx=	7.00 IN
Tube Steel Section: (X Axis):		dy=	5.00 IN
Tube Steel Section: (Y Axis):		t=	0.233 IN
Tube Steel Wall Thickness:		A=	5.24 IN <sup>2</sup>
Area:		Ix=	35.90 IN <sup>4</sup>
Moment of Inertia (X Axis):		Sx=	10.20 IN <sup>3</sup>
Section Modulus (X Axis):			
Design Properties per AISC Steel Construction Manual:		FBR=	30.04
Flange Buckling Ratio:		AFBR=	28.01
Allowable Flange Buckling Ratio:		Lb=	8.0 FT
Controlling Unbraced Length:		Lc=	10.87 FT
Limiting Unbraced Length for Fb = .66*Fy:		Fb=	27.6 KSI
Allowable Bending Stress:		(dx-2)t=	28.04



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<p>TG</p> <p>Date:</p> <p>8/4/09</p>	<p>Structural Calculations for:</p> <p><b>Williams Residence</b></p> <p>20680 Mockingbird Rd        Bodega Bay, CA</p>	<p>Job #09018</p> <p>14 of 58</p>
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Page: 13			
Multi-Loaded Beam [ AISC 9th Ed ASD ] Ver: 7.01.12			
By: Todd Green P.E., Green Engineering on: 09-16-2009 : 08:47:48 AM			
Project: WILLIAMS - Location: DECK OUTRIGGER BEAMS (TYP. OF 2)			
Limiting Width to Thickness Ratio for $F_v = 0.4 F_y$ :	AWSL=	56.03	
Allowable Shear Stress:	Fv=	18.4	KSI
Design Requirements Comparison:			
Controlling Moment:	M=	-5001	FT-LB
Over right support of span 2 (Center Span)			
Critical moment created by combining all dead loads and live loads on span(s) 2, 3			
Nominal Moment Strength:	Mr=	23460	FT-LB
Controlling Shear:	V=	1658	LB
At left support of span 2 (Center Span)			
Critical shear created by combining all dead loads and live loads on span(s) 2, 3			
Nominal Shear Strength:	Vr=	56025	LB
Moment of Inertia (Deflection):	Ireq=	31.38	IN4
	I=	35.90	IN4



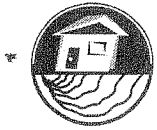
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TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	15 of 58

Multi-Loaded Beam [ 2006 International Building Code (05 NDS) ] Ver: 7.01.12			
By: Todd Green P.E. , Green Engineering on: 09-16-2009 : 08:47:49 AM			
Project: WILLIAMS - Location: LOFT STAIR HEADOUT			
Summary:			
3.5 IN x 9.5 IN x 11.5 FT / 1.9E Microllam - iLevel Trus Joist			
Section Adequate By: 150.0% Controlling Factor: Moment of Inertia / Depth Required 7.0 In			
Center Span Deflections:			
Dead Load:	DLD-Center=	0.06	IN
Live Load:	LLD-Center=	0.10	IN = L/1414
Total Load:	TLD-Center=	0.15	IN = L/900
Center Span Left End Reactions (Support A):			
Live Load:	LL-Rxn-A=	784	LB
Dead Load:	DL-Rxn-A=	437	LB
Total Load:	TL-Rxn-A=	1220	LB
Bearing Length Required (Beam only, support capacity not checked):	BL-A=	0.46	IN
Center Span Right End Reactions (Support B):			
Live Load:	LL-Rxn-B=	477	LB
Dead Load:	DL-Rxn-B=	293	LB
Total Load:	TL-Rxn-B=	771	LB
Bearing Length Required (Beam only, support capacity not checked):	BL-B=	0.29	IN
Beam Data:			
Center Span Length:	L2=	11.5	FT
Center Span Unbraced Length-Top of Beam:	Lu2-Top=	0.0	FT
Center Span Unbraced Length-Bottom of Beam:	Lu2-Bottom=	11.5	FT
Live Load Duration Factor:	Cd=	1.00	
Live Load Deflect. Criteria:	L/	480	
Total Load Deflect. Criteria:	L/	360	
Center Span Loading:			
Uniform Load:			
Live Load:	wL-2=	54	PLF
Dead Load:	wD-2=	27	PLF
Beam Self Weight:	BSW=	10	PLF
Total Load:	wT-2=	91	PLF
Point Load 1			
Live Load:	PL1-2=	640	LB
Dead Load:	PD1-2=	300	LB
Location (From left end of span):	X1-2=	3.0	FT
Properties For: 1.9E Microllam - iLevel Trus Joist			
Bending Stress:	Fb=	2600	PSI
Shear Stress:	Fv=	285	PSI
Modulus of Elasticity:	E=	1900000	PSI
Stress Perpendicular to Grain:	Fc_perp=	750	PSI
Adjusted Properties			
Fb' (Tension):	Fb'=	2684	PSI
Adjustment Factors: Cd=1.00 CF=1.03			
Fv':	Fv'=	285	PSI
Adjustment Factors: Cd=1.00			
Design Requirements:			
Controlling Moment:	M=	3250	FT-LB
3.105 Ft from left support of span 2 (Center Span)			
Critical moment created by combining all dead loads and live loads on span(s) 2			
Controlling Shear:	V=	1157	LB
At a distance d from left support of span 2 (Center Span)			
Critical shear created by combining all dead loads and live loads on span(s) 2			
Comparisons With Required Sections:			
Section Modulus (Moment):	Sreq=	14.53	IN3
	S=	52.65	IN3
Area (Shear):	Areq=	6.09	IN2
	A=	33.25	IN2
Moment of Inertia (Deflection):	Ireq=	100.04	IN4
	I=	250.07	IN4



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TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	16 of 58

Roof Rafter [ 2006 International Building Code (05 NDS) ] Ver: 7.01.12 By: Todd Green P.E. , Green Engineering on: 09-16-2009 : 08:47:51 AM			
Project: WILLIAMS - Location: TYP. (N) RAFTER @ FAMILY (LONG SPAN)			
Summary:			
1.5 IN x 11.25 IN x 18.0 FT @ 12 O.C. / #2 - Western Cedars - Dry Use			
Section Adequate By: 90.3% Controlling Factor: Section Modulus / Depth Required 9.07 In			
Rafter Span Deflections:			
Dead Load:	DLD-Interior=	0.20	IN
Live Load:	LLD-Interior=	0.28	IN = L/790
Total Load:	TLD-Interior=	0.49	IN = L/459
Rafter End Loads and Reactions:	LOADS:	RXNS:	
Upper Live Load:	180 PLF	180 LB	
Upper Dead Load:	130 PLF	130 LB	
Upper Total Load:	310 PLF	310 LB	
Lower Live Load:	180 PLF	180 LB	
Lower Dead Load:	130 PLF	130 LB	
Lower Total Load:	310 PLF	310 LB	
Upper Equiv. Tributary Width:	UTWeq=	9.28	FT
Lower Equiv. Tributary Width:	LTWeq=	9.28	FT
Rafter Data:			
Interior Span:	L=	18.0	FT
Eave Span:	L-Eave=	0.0	FT
Rafter Spacing:	Spacing=	12.0	IN O.C.
Rafter Pitch:	RP=	3.0	: 12
Roof sheathing applied to top of joists-Top of rafters fully braced.			
Live Load Deflect. Criteria:	L/	360	
Total Load Deflect. Criteria:	L/	240	
Rafter Loads:			
Roof Live Load:	LL=	20.0	PSF
Roof Dead Load:	DL=	14.0	PSF
Roof Duration Factor:	Cd=	1.25	
Slope Adjusted Spans And Loads:			
Interior Span:	L-adj=	18.55	FT
Rafter Live Load:	wL-adj=	19	PLF
Rafter Dead Load:	wD-adj=	14	PLF
Rafter Total Load:	wT-adj=	32	PLF
Properties For: #2- Western Cedars			
Bending Stress:	Fb=	700	PSI
Shear Stress:	Fv=	155	PSI
Modulus of Elasticity:	E=	1000000	PSI
Adjusted Modulus of Elasticity:	E-Min=	370000	PSI
Stress Perpendicular to Grain:	Fc-perp=	425	PSI
Adjusted Properties			
Fb' (Tension):	Fb'=	1006	PSI
Adjustment Factors: Cd=1.25 CF=1.00 Cr=1.15			
Fv':	Fv'=	194	PSI
Adjustment Factors: Cd=1.25			
Design Requirements:			
Controlling Moment:	M=	1394	FT-LB
9.277 Ft from left support of span 2 (Center Span)			
Critical moment created by combining all dead loads and live loads on span(s) 2			
Controlling Shear:	V=	271	LB
At a distance d from left support of span 2 (Center Span)			
Critical shear created by combining all dead loads and live loads on span(s) 2			
Comparisons With Required Sections:			
Section Modulus (Moment):	Sreq=	16.63	IN3
	S=	31.64	IN3
Area (Shear):	Areq=	2.09	IN2
	A=	16.88	IN2
Moment of Inertia (Deflection):	Ireq=	93.13	IN4
	I=	177.98	IN4



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TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	17 of 58

Roof Rafter   2006 International Building Code (05 NDS)   Ver: 7.01.12			
By: Todd Green P.E., Green Engineering on: 09-16-2009 : 08:47:53 AM			
Project: WILLIAMS - Location: TYP. (N) RAFTER @ FAMILY			
Summary:			
1.5 IN x 11.25 IN x 17.0 FT @ 24 O.C. / #2 - Western Cedars - Dry Use			
Section Adequate By: 6.7% Controlling Factor: Section Modulus / Depth Required 10.89 In			
Rafter Span Deflections:		DLD-Interior=	0.32 IN
Dead Load:		LLD-Interior=	0.45 IN = L/469
Live Load:		TLD-Interior=	0.77 IN = L/272
Total Load:		LOADS:	RXNS:
Rafter End Loads and Reactions:		170 PLF	340 LB
Upper Live Load:		123 PLF	245 LB
Upper Dead Load:		293 PLF	585 LB
Upper Total Load:		170 PLF	340 LB
Lower Live Load:		123 PLF	245 LB
Lower Dead Load:		293 PLF	585 LB
Lower Total Load:		UTWeq=	8.76 FT
Upper Equiv. Tributary Width:		LTWeq=	8.76 FT
Lower Equiv. Tributary Width:			
Rafter Data:			
Interior Span:		L=	17.0 FT
Eave Span:		L-Eave=	0.0 FT
Rafter Spacing:		Spacing=	24.0 IN O.C.
Rafter Pitch:		RP=	3.0 : 12
Roof sheathing applied to top of joists-Top of rafters fully braced.			
Live Load Deflect. Criteria:		L/	360
Total Load Deflect. Criteria:		L/	240
Rafter Loads:			
Roof Live Load:		LL=	20.0 PSF
Roof Dead Load:		DL=	14.0 PSF
Roof Duration Factor:		Cd=	1.25
Slope Adjusted Spans And Loads:			
Interior Span:		L-adj=	17.52 FT
Rafter Live Load:		wL-adj=	38 PLF
Rafter Dead Load:		wD-adj=	27 PLF
Rafter Total Load:		wT-adj=	65 PLF
Properties For: #2- Western Cedars			
Bending Stress:		Fb=	700 PSI
Shear Stress:		Fv=	155 PSI
Modulus of Elasticity:		E=	1000000 PSI
Adjusted Modulus of Elasticity:		E-Min=	370000 PSI
Stress Perpendicular to Grain:		Fc-perp=	425 PSI
Adjusted Properties			
Fb' (Tension):		Fb'=	1006 PSI
Adjustment Factors: Cd=1.25 CF=1.00 Cr=1.15			
Fv':		Fv'=	194 PSI
Adjustment Factors: Cd=1.25			
Design Requirements:			
Controlling Moment:		M=	2488 FT-LB
8.762 Ft from left support of span 2 (Center Span)			
Critical moment created by combining all dead loads and live loads on span(s) 2			
Controlling Shear:		V=	511 LB
At a distance d from left support of span 2 (Center Span)			
Critical shear created by combining all dead loads and live loads on span(s) 2			
Comparisons With Required Sections:			
Section Modulus (Moment):		Sreq=	29.67 IN3
		S=	31.64 IN3
Area (Shear):		Areq=	3.96 IN2
		A=	16.88 IN2
Moment of Inertia (Deflection):		Ireq=	156.90 IN4
		I=	177.98 IN4



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TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	18 of 58

Roof Rafter [ 2006 International Building Code (05 NDS) ] Ver: 7.01.12 By: Todd Green P.E. , Green Engineering on: 09-16-2009 : 08:47:54 AM			
Project: WILLIAMS - Location: TYP. (N) RAFTER @ LOFT			
Summary: TJI 230 / 11.875 - iLevel Trus Joist x 21.0 FT (21 + 0) @ 12 O.C. Section Adequate By: 96.6% Controlling Factor: Allowable Deflection * I-joists were Preliminarily designed using the joist manufacturers published values. If the design does not match the actual joist loading or span conditions in any way, contact the joist manufacturer for design verification.			
Rafter Span Deflections:		DLD-Interior=	0.23 IN
Dead Load:		LLD-Interior=	0.32 IN = L/812
Live Load:		TLD-Interior=	0.55 IN = L/472
Total Load:		LOADS:	RXNS:
Rafter End Loads and Reactions:		210 PLF	210 LB
Upper Live Load:		152 PLF	152 LB
Upper Dead Load:		362 PLF	362 LB
Upper Total Load:		210 PLF	210 LB
Lower Live Load:		152 PLF	152 LB
Lower Dead Load:		362 PLF	362 LB
Lower Total Load:		UTWeq=	10.5 FT
Upper Equiv. Tributary Width:		LTWeq=	10.5 FT
Lower Equiv. Tributary Width:			
Rafter Data:		L=	21.0 FT
Interior Span:		L-Eave=	0.0 FT
Eave Span:		Spacing=	12.0 IN O.C.
Rafter Spacing:		RP=	: 12
Rafter Pitch:			
Roof sheathing applied to top of joists-Top of rafters fully braced.			
Live Load Deflect. Criteria:		L/	360
Total Load Deflect. Criteria:		L/	240
Rafter Loads:		LL=	20.0 PSF
Roof Live Load:		DL=	14.0 PSF
Roof Dead Load:		Cd=	1.25
Roof Duration Factor:			
Slope Adjusted Spans And Loads:		L-adj=	21.65 FT
Interior Span:		wL-adj=	19 PLF
Rafter Live Load:		wD-adj=	14 PLF
Rafter Dead Load:		wT-adj=	32 PLF
Rafter Total Load:			
Properties For: TJI 230 / 11.875- iLevel Trus Joist		D=	11.875 IN
Depth:		Mcap=	4015 FT-LB
Moment Capacity:		Vcap=	1655 LB
Shear Capacity:		EI=	310000000 LB-IN2
EI:		Rcap=	1035 LB
End Reaction Capacity:			
Comparisons With Required Sections:		M=	1898 FT-LB
Controlling Moment:		Mcap-adj=	5019 FT-LB
Adjusted Moment Capacity:		V=	351 LB
Controlling Shear:		Vcap-adj=	2069 LB
Adjusted Shear Capacity:		EI-req=	157654500 LB-IN2
EI Required:		EI=	310000000 LB-IN2
EI:		Rmax=	362 LB
Maximum End Reaction:		Rcap-adj=	1294 LB
Adjusted Reaction Capacity:			



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TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	19 of 58

Floor Joist [ 2006 International Building Code (05 NDS) ] Ver: 7.01.12 By: Todd Green P.E. , Green Engineering on: 09-16-2009 : 08:47:56 AM			
Project: WILLIAMS - Location: TYP. DECK JOIST			
Summary:			
1.5 IN x 7.25 IN x 14.0 FT (10 + 4) @ 12 O.C. / #1 - Douglas-Fir-Larch (North) - Dry Use			
Section Adequate By: 3.5% Controlling Factor: Section Modulus / Depth Required 7.13 In			
Center Span Deflections:		DLD-Center=	0.06 IN
Dead Load:		LLD-Center=	0.09 IN = L/1337
Live Load:		TLD-Center=	0.15 IN = L/801
Total Load:			
Right Span Deflections:		DLD-Right=	-0.01 IN
Dead Load:		LLD-Right=	-0.01 IN = L/4387
Live Load:		TLD-Right=	-0.02 IN = L/2927
Total Load:			
Center Span Left End Reactions (Support A):		LL-Rxn-A=	205 LB
Live Load:		DL-Rxn-A=	142 LB
Dead Load:		TL-Rxn-A=	347 LB
Total Load:		BL-A=	0.37 IN
Bearing Length Required (Beam only, support capacity not checked):			
Center Span Right End Reactions (Support B):		LL-Rxn-B=	516 LB
Live Load:		DL-Rxn-B=	361 LB
Dead Load:		TL-Rxn-B=	878 LB
Total Load:		BL-B=	0.94 IN
Bearing Length Required (Beam only, support capacity not checked):			
Right End Reactions (Support C):		LL-Rxn-C=	93 LB
Live Load:		DL-Rxn-C=	-13 LB
Dead Load:		TL-Rxn-C=	80 LB
Total Load:		Rxn-C-min=	-125 LB
Design For Uplift Loads (Includes Uplift Factor of Safety)			
Bearing Length Required (Beam only, support capacity not checked):			
Dead Load Uplift F.S.:			
		BL-C=	0.09 IN
		FS=	1.0
Joist Data:		L2=	10.0 FT
Center Span Length:		L3=	4.0 FT
Right Span Length:	Floor sheathing applied to top of joists-top of joists fully braced.		
Live Load Duration Factor:		Cd=	1.00
Live Load Deflect. Criteria:		L/	480
Total Load Deflect. Criteria:		L/	360
Center Span Loading:			
Uniform Floor Loading:		LL-2=	50.0 PSF
Live Load:		DL-2=	35.0 PSF
Dead Load:		TL-2=	85.0 PSF
Total Load:		wT-2=	85 PLF
Total Load Adjusted for Joist Spacing:			
Right Span Loading:			
Uniform Floor Loading:		LL-3=	50.0 PSF
Live Load:		DL-3=	35.0 PSF
Dead Load:		TL-3=	85.0 PSF
Total Load:		wT-3=	85 PLF
Total Load Adjusted for Joist Spacing:			
Properties For: #1- Douglas-Fir-Larch (North)		Fb=	850 PSI
Bending Stress:		Fv=	180 PSI
Shear Stress:		E=	1600000 PSI
Modulus of Elasticity:		E-Min=	580000 PSI
Adjusted Modulus of Elasticity:		Fc-perp=	625 PSI
Stress Perpendicular to Grain:			
Adjusted Properties		Fb'=	763 PSI
Fb' (Compression Face in Tension):		Fv'=	180 PSI
Adjustment Factors: Cd=1.00 Ci=0.81 CF=1.20 Cr=1.15 Ci=0.80		E'=	1520000 PSI
Fv':		E-Min'=	551000 PSI
Adjustment Factors: Cd=1.00			
E':		Fc'-perp=	625 PSI
E-Min':			
Adjustment Factors: Cm=1.00			
Fc'-perp:			
Adjustment Factors: Cm=1.00 Ci=0.95			



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TG  Date: 8/4/09	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	Job #09018  20 of 58
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Page: 19			
Floor Joist [ 2006 International Building Code (05 NDS) ] Ver: 7.01.12			
By: Todd Green P.E. , Green Engineering on: 09-16-2009 : 08:47:56 AM			
Project: WILLIAMS - Location: TYP. DECK JOIST			
Controlling Moment:	M=	-808	FT-LB
Over right support of span 2 (Center Span)			
Critical moment created by combining all dead loads and live loads on span(s) 2, 3			
Controlling Shear:	V=	455	LB
At a distance d from right support of span 2 (Center Span)			
Critical shear created by combining all dead loads and live loads on span(s) 2, 3			
Comparisons With Required Sections:			
Section Modulus (Moment):	Sreq=	12.70	IN3
	S=	13.14	IN3
Area (Shear):	Areq=	3.79	IN2
	A=	10.88	IN2
Moment of Inertia (Deflection):	Ireq=	21.40	IN4
	I=	47.63	IN4



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TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	21 of 58

Floor Joist  2006 International Building Code (05 NDS)   Ver: 7.01.12 By: Todd Green P.E. , Green Engineering on: 09-16-2009 : 08:47:57 AM			
Project: WILLIAMS - Location: TYP. LOFT JOIST			
Summary:			
TJI 230 / 9.5 - iLevel Trus Joist x 12.0 FT @ 16 O.C.			
Section Adequate By: 84.7% Controlling Factor: Allowable Deflection			
* I-joists were Preliminarily designed using the joist manufacturers published values.			
If the design does not match the actual joist loading or span conditions in any way, contact the joist manufacturer for design verification.			
Center Span Deflections:			
Dead Load:	DLD-Center=	0.06	IN
Live Load:	LLD-Center=	0.16	IN = L/914
Total Load:	TLD-Center=	0.22	IN = L/665
Center Span Left End Reactions (Support A):			
Live Load:	LL-Rxn-A=	320	LB
Dead Load:	DL-Rxn-A=	120	LB
Total Load:	TL-Rxn-A=	440	LB
Bearing Length Required (Beam only, support capacity not checked):			
	BL-A=	1.75	IN
Center Span Right End Reactions (Support B):			
Live Load:	LL-Rxn-B=	320	LB
Dead Load:	DL-Rxn-B=	120	LB
Total Load:	TL-Rxn-B=	440	LB
Bearing Length Required (Beam only, support capacity not checked):			
	BL-B=	1.75	IN
Joist Data:			
Center Span Length:	L2=	12.0	FT
Floor sheathing applied to top of joists-top of joists fully braced.			
Live Load Duration Factor:	Cd=	1.00	
Live Load Deflect. Criteria:	L/	480	
Total Load Deflect. Criteria:	L/	360	
Center Span Loading:			
Uniform Floor Loading:			
Live Load:	LL-2=	40.0	PSF
Dead Load:	DL-2=	15.0	PSF
Total Load:	TL-2=	55.0	PSF
Total Load Adjusted for Joist Spacing:	wT-2=	73	PLF
Properties For: TJI 230 / 9.5- iLevel Trus Joist			
Depth:	D=	9.5	IN
Moment Capacity:	Mcap=	3175	FT-LB
Shear Capacity:	Vcap=	1330	LB
EI:	EI=	183000000	LB-IN2
End Reaction Capacity:	Rcap=	1035	LB
Comparisons With Required Sections:			
Controlling Moment:	M=	1320	FT-LB
Adjusted Moment Capacity:	Mcap-adj=	3175	FT-LB
Controlling Shear:	V=	440	LB
Adjusted Shear Capacity:	Vcap-adj=	1330	LB
EI Required:	EI-req=	99099460	LB-IN2
EI:	EI=	183000000	LB-IN2
Maximum End Reaction:	Rmax=	440	LB
Adjusted Reaction Capacity:	Rcap-adj=	1035	LB



TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd	22 of 58
	Bodega Bay, CA	

DETERMINE ESCARPMENT:

$\frac{H}{L_h} = .3$       ∴  $K_1 = .43$

$\frac{X}{L_h} = .125$       ∴  $K_2 = 1.0$       USE

$\frac{Z}{L_h} = .25$       ∴  $K_3 = .48$

∴  $K_{zt} = (1 + K_1 K_2 K_3)^2 = 1.45$

USE  $K_{zt} = \underline{\underline{1.45}}$



<p>TG</p> <p>Date:</p> <p>8/4/09</p>	<p>Structural Calculations for:</p> <p><b>Williams Residence</b></p> <p>20680 Mockingbird Rd Bodega Bay, CA</p>	<p>Job #09018</p> <p>23 of 58</p>
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WINDS MWFRS

$$\omega P_s = \omega \lambda K_{zt} I P_{s30}$$

A B C D E F G H

11.5 -5.9 7.6 -3.5 13.3 -7.8 9.6 -6.1

$$\omega = 1.3$$

$$\lambda_2 = 1.58 \text{ (22 ft Area Exp D)}$$

$$\lambda_1 = 1.47 \text{ (12 ft Area Exp D)}$$

$$I = 1.0$$

$$K_{zt} = 1.45$$

$$A_{R1} = 31.9 \text{ psf}$$

$$A_{R2} = 34.2 \text{ psf}$$

$$C_{R1} = 21.0 \text{ psf}$$

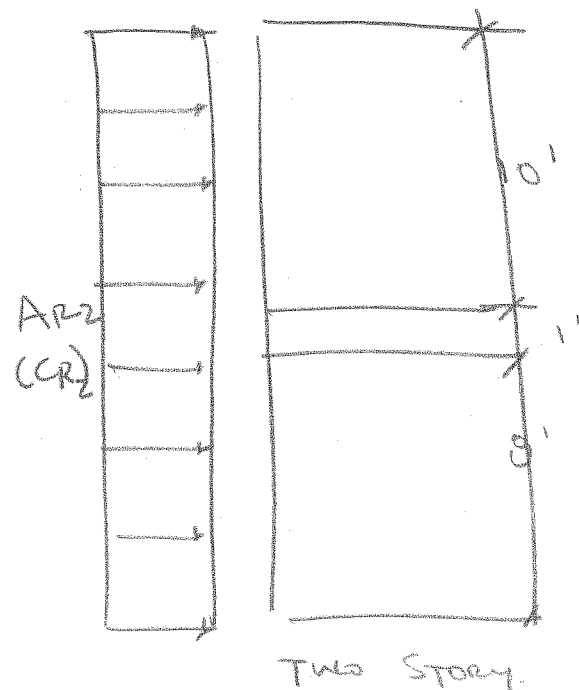
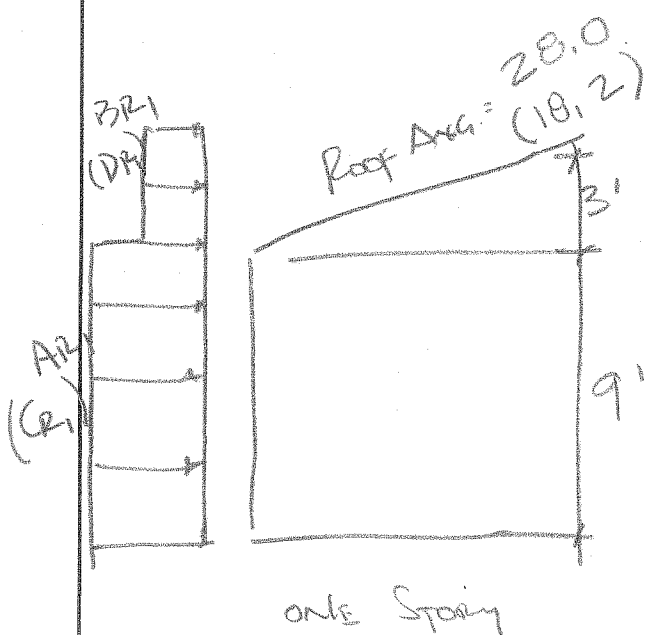
$$C_{R2} = 22.6 \text{ psf}$$

$$B_{R1} = 16.3 \text{ psf}$$

$$B_{R2} = 17.5 \text{ psf}$$

$$D_{R1} = 9.7 \text{ psf}$$

$$D_{R2} = 10.4 \text{ psf}$$





TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	24 of 50

2 STORY ROOF  
@ FAMILY →

WIND CONTROLS

SIDE-SIDE CORNER =  $34.2 \times 14 = 478 \text{ psf}$   
@ FAMILY

or 22.3 psf

SIDE-SIDE TRP. =  $22.6 \times 14 = 316 \text{ psf}$   
@ FAMILY.

or 14.0 psf

FRONT-BACK CORNER =  $34.2 \times 14 = 478 \text{ psf}$   
@ FAMILY.

or 19.9 psf

FRONT-BACK TRP. =  $22.6 \times 14 = 316 \text{ psf}$   
@ FAMILY.

or 13.1 psf



<p>TG</p> <p>Date:</p> <p>8/4/09</p>	<p>Structural Calculations for:</p> <p><b>Williams Residence</b></p> <p>20680 Mockingbird Rd Bodega Bay, CA</p>	<p>Job #09018</p> <p>25 of 58</p>
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UPPER FLOOR  
@ BED 1+2 →

WIND CONTROLS

SIDE-SIDE CORNER =  $34.2 \times [9] = 308 \text{ psf}$   
@ BED 1+2  
or 14.0 psf

SIDE-SIDE TYP. =  $22.6 \times [9] = 203 \text{ psf}$   
@ BED 1+2  
or 9.2 psf

FRONT-BACK CORNER =  $34.2 \times [9] = 308 \text{ psf}$   
@ BED 1+2  
or 12.0 psf

FRONT-BACK TYP. =  $22.6 \times [9] = 203 \text{ psf}$   
@ BED 1+2  
or 8.5 psf



TG	Structural Calculations for:	Job #09018
Date: 8/4/09	Williams Residence 20680 Mockingbird Rd Bodega Bay, CA	26 of 58

2 STORY ROOF →  
@ MASTER

WIND CONTROLS

SIDE-SIDE CORNER =  $34.2 \times (10) = 342 \text{ psf}$   
@ MASTER or 16.3 psf

SIDE-SIDE TYP. =  $22.6 \times (10) = 226 \text{ psf}$   
@ MASTER or 10.7 psf

FRONT BACK CORNER =  $34.2 \times (10) = 342 \text{ psf}$   
@ MASTER or 14.3 psf

FRONT BACK TYPICAL =  $22.6 \times (10) = 226 \text{ psf}$   
@ MASTER or 9.4 psf



TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	27 of 58

UPPER FLOOR  
@ BED #3  
WIND CONTROLS

$$\text{SIDE-SIDE CORNER} = 34.2 \times [9] = 308 \text{ pf}$$

@ BED #3

$$\text{or } \underline{11.0 \text{ psf}}$$

$$\text{SIDE-SIDE MP} = 22.6 \times [9] = 203 \text{ pf}$$

@ BED #3

$$\text{or } \underline{7.25 \text{ psf}}$$

$$\text{FRONT-BACK CORNER} = 34.2 \times [9] = 308 \text{ pf}$$

@ BED #3

$$\text{or } \underline{15.4 \text{ psf}}$$

$$\text{FRONT-BACK MP} = 22.6 \times [9] = 203 \text{ pf}$$

@ BED #3

$$\text{or } \underline{9.6 \text{ psf}}$$



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TG  Date: 8/4/09	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	Job #09018  20 of 50
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2 STORY ROOF  
e LOFT



WIND CONTROLS

SIDE-SIDE CORNER =  $34.2 \times [10] = 342 \text{ psf}$   
 e LOFT  
 or 16.0 psf

SIDE-SIDE TRP =  $22.6 \times [10] = 226 \text{ psf}$   
 e LOFT  
 or 10.5 psf

FRONT-BACK CORNER =  $34.2 \times [10] = 342 \text{ psf}$   
 e LOFT  
 or 15.2 psf

FRONT-BACK TRP =  $22.6 \times [10] = 226 \text{ psf}$   
 e LOFT  
 or 10.0 psf



<p>TG</p> <p>Date:</p> <p>8/4/09</p>	<p>Structural Calculations for:</p> <p><b>Williams Residence</b></p> <p>20680 Mockingbird Rd Bodega Bay, CA</p>	<p>Job #09018</p> <p>29 of 50</p>
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UPPER FLOOR  
@ GARAGE



WIND CONTROLS

SIDE-SIDE CORNER =  $34.2 \times [9] = 308 \text{ psf}$   
@ GARAGE

or 14.7 psf

SIDE-SIDE TYP =  $22.6 \times [9] = 203 \text{ psf}$   
@ GARAGE

9.3 psf

FRONT-BACK CORNER =  $34.2 \times 9 = 308 \text{ psf}$   
@ GARAGE

13.4 psf

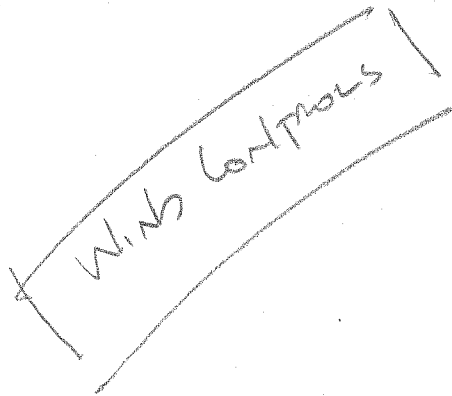
FRONT-BACK TYP =  $22.6 \times 9 = 203 \text{ psf}$   
@ GARAGE

9.1 psf



TG	Structural Calculations for:	Job #09018
Date: 8/4/09	Williams Residence 20680 Mockingbird Rd Bodega Bay, CA	30 of 58

ONE - STORY ROOF  
@ KITCHEN



SIDE-SIDE CORNER =  $28 \times [12] = 336 \text{ psf}$   
@ KITCHEN  
or 15.6 psf

SIDE-SIDE TYPICAL =  $18.2 \times [12] = 218 \text{ psf}$   
@ KITCHEN  
or 10.0 psf

FRONT-BACK CORNER =  $28 \times [12] = 336 \text{ psf}$   
@ KITCHEN  
or 14 psf

FRONT-BACK TYPICAL =  $18.2 \times 12 = 218 \text{ psf}$   
@ KITCHEN  
or 9.1 psf



<p>TG</p> <p>Date:</p> <p>8/4/09</p>	<p>Structural Calculations for:</p> <p><b>Williams Residence</b></p> <p>20680 Mockingbird Rd Bodega Bay, CA</p>	<p>Job #09018</p> <p>31 of 58</p>
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SEISMIC:  $\gamma = .44W$

Roof e FAMILY  $\rightarrow$

$$W_{\text{roof}} = 800 \text{ } \phi \times 14 = 11200 \text{ } \#$$

$$W_{\text{walls}} = (30\%) = \underline{3360 \text{ } \#}$$

$$.44(14560) = 6406 \text{ } \#$$

$\therefore E = \frac{6406}{1.4} = 4576 \text{ } \#$  or 5.7 psf

$\therefore$  SEISMIC DOES NOT CONTROL

Roof e LOFT / MASTER  $\rightarrow$

$$W_{\text{roof}} = 1300 \text{ } \phi \times 14 = 18200 \text{ } \#$$

$$W_{\text{walls}} = (30\%) = \underline{5460 \text{ } \#}$$

$$.44(23660)$$

$\therefore E = \frac{10410}{1.4} = 7436 \text{ } \#$  or 5.7 psf = 10410

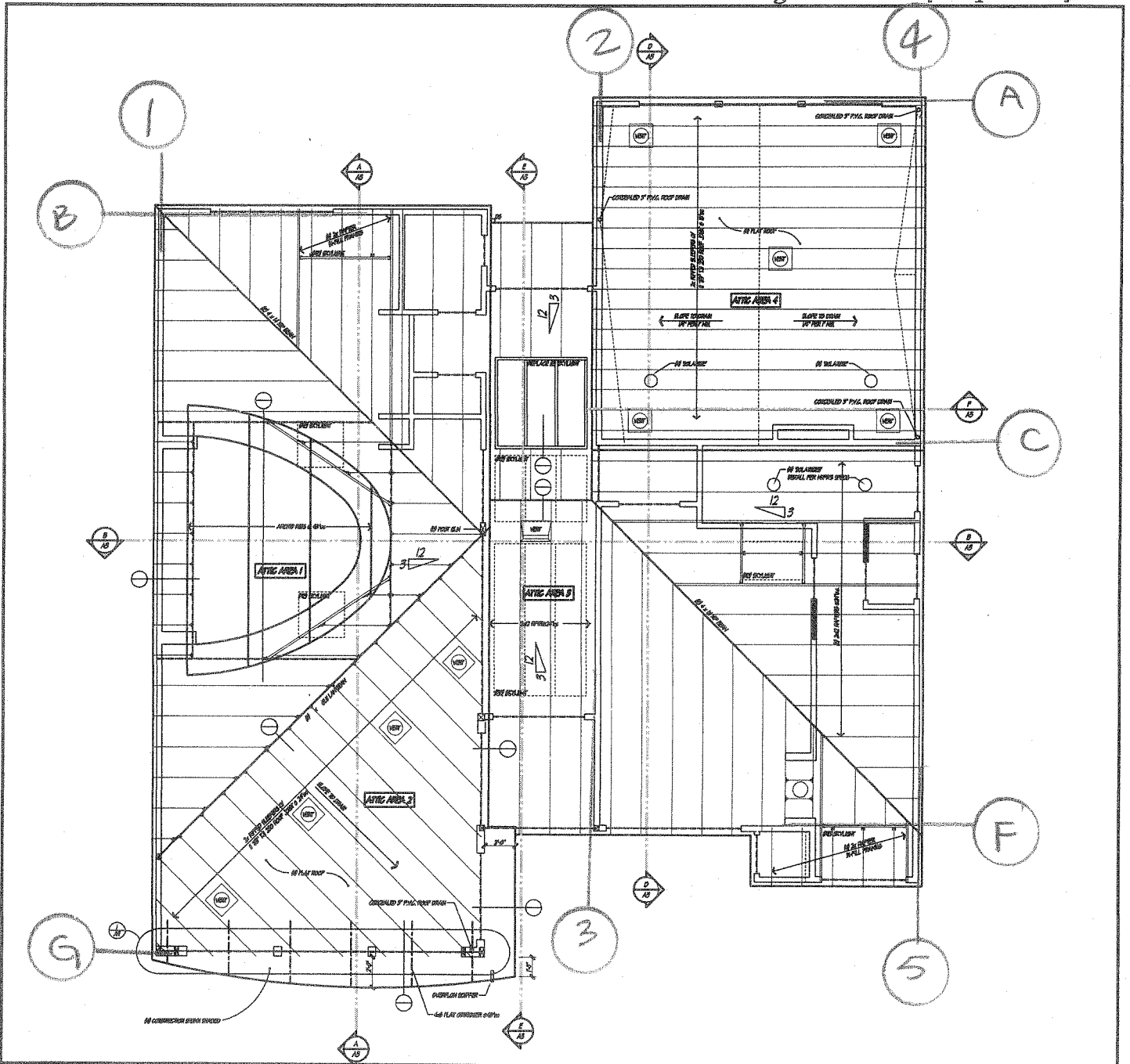
$\therefore$  SEISMIC DOES NOT CONTROL



<p>TG Date: 8/4/09</p>	<p>Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA</p>	<p>Job #09018  32 of 58</p>
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Lateral Review

All grided walls, u.n.o. by this design, conform to the bracing requirements of the Conventional Construction Provisions of the *California Building Code 2007 [Chap 2308]*





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TG  Date: 8/4/09	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	Job #09018  33 of 58
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ROOF

LINE ① -  $418 \times [3] + 316 \times [12] = 5226 \#$

$5226 \# / 48 = 108 \text{ pcf}$

∴ USE (A6)

HO  
 $108 \times 9 = 979 \#$

∴ HD<sup>13</sup> NEGLIGIBLE

LINE ② -  $218 \times [15] + 342 \times [3] + 226 \times [8] = 6104 \#$

$6104 \# / 17 = 360 \text{ pcf}$

USE (A6)

HO  
 $360 \times 7 = 2513 \#$

USE HDU2

LINE ③ -  $316 \times [15] + 226 \times [11] = 7226 \#$

$7226 \# / 10 = 722 \text{ pcf}$

USE (A3)

HO'  
 $722 \times 8 = 5780 \#$

USE HDU8



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Roof

LINE (A) -  $342 \times [3] + 226 \times [8] = 2934^{\#}$

$2934^{\#} / 22 = 129 \text{ pt}$

USE (AG)

$129 \times 7 = 901^{\#}$

1" HD" NEGLIGIBLE

LINE (S) -  $342 \times [3] + 226 \times [8] = 2934^{\#}$

$2934^{\#} / 15 = 189 \text{ pt}$

USE (AG)

$189 \times 8 = 1511^{\#}$

USE HDU2



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ROOF

LINE (A)  $342 \times [3] + 226 \times [0] = 2934^{\#}$

$2934^{\#} / 2 = 1417^{\#}$

USE HF PANELS

SEE UPPER FL DESIGN  
FOR DBL STACK  
CONDITION

LINE (B)  $336 \times [5] + 218 \times [19] = 5822^{\#}$

$5822^{\#} / 9.5 = 612 \text{ pcf}$

HO

$612 \times 9 = 5515^{\#}$

USE (AA)

USE HDUB

LINE (C)  $226 \times [11 + \frac{25}{2}] = 5245^{\#}$

$5245^{\#} / 15 = \frac{349}{309} \text{ pcf}$

NO

(E) FOR AT

USE (AG)

WALL



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---------------------------	---	----------------------------

Roof

LINE (F) -  $336 \times (5) + 218 \times (7.5) = 3315 \#$

$3315 \# / 4 = 828 \text{ plf}$

USE (A3)

NO  
 $828 \times 8 = 6630 \#$

USE HDU8

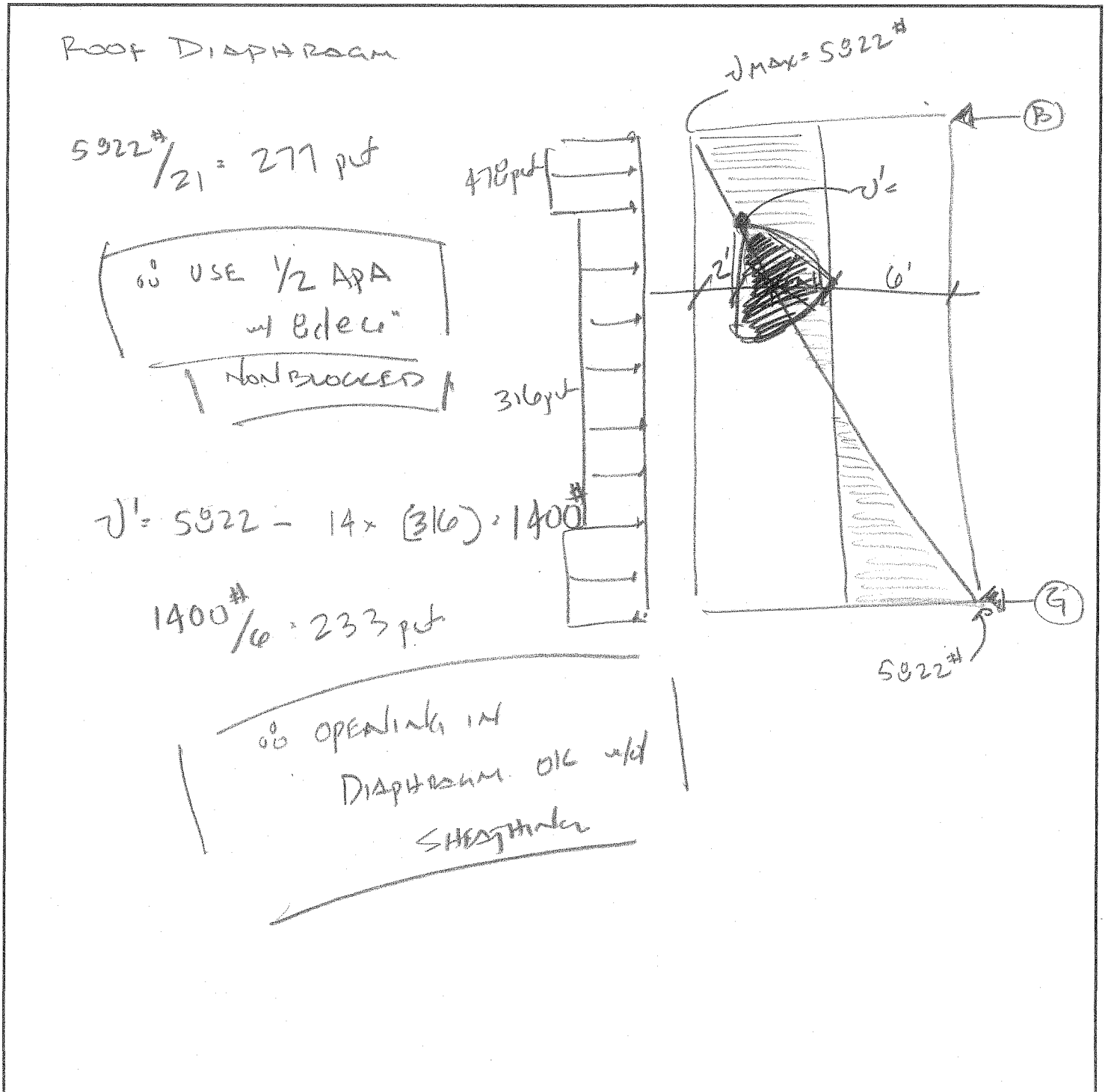
LINE (G) -  $336 \times (5) + 218 \times (19) = 5822 \#$

$5822 \# / 20 = 290 \text{ plf} \rightarrow$

SEE MF#1 ANALYSIS



<p>TG</p> <p>Date: 8/4/09</p>	<p>Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA</p>	<p>Job #09018</p> <p>37 of 58</p>
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---------------------------	---	----------------------------

LINE ① -  $5226 \frac{\#}{2} + 308 \times [3] + 203 \times [12] = 5973 \frac{\#}{2}$   
OR ASSUME 1/2 LOAD IN CRIPPLE BEYOND. (3300 #)

$5973 \frac{\#}{19} = 314 \text{ plf}$

USE **AG**

$314 \times 9 = 2829 \frac{\#}{2}$

**USE HDU2**

LINE ② -  $6104 \frac{\#}{2} + 308 \times [3] + 203 \times [7.5]$   
 $+ 218 \times [14.5] = 11711 \frac{\#}{2}$   
(5607 #)

$11711 \frac{\#}{22} = 532 \text{ plf}$

USE **AA**

$532 \times 8 = 4258 \frac{\#}{2}$

**USE HDU5**



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<p>TG</p> <p>Date:</p> <p>8/4/09</p>	<p>Structural Calculations for:</p> <p><b>Williams Residence</b></p> <p>20680 Mockingbird Rd Bodega Bay, CA</p>	<p>Job #09018</p> <p>40 of 58</p>
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UPPER

LINE (3) -  $7226 \# + 316 \times \left[\frac{29}{2}\right] + 226 \times \left[\frac{21}{2}\right] = 14181$   
(6955#)

$14181 \# / 10 = 1418 \text{ pt}$

USE 

HD

$1418 \times 8 = 11345 \#$

USE HD 11

LINE (4) -  $2834 \# + 308 [3] + 203 \times [7.5] = 3280 \#$   
(2446)

$3280 \# / 22 = 149 \text{ pt}$

USE 

HD

$149 \times 8 = 1192 \#$

USE HD NEGLECTIBLE



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Upper

LINE (S) -  $2934^{\#} + 342 \times [3] + 226 \times [7.5] = 5555^{\#}$   
 (2721<sup>#</sup>)

$5555^{\#} / 15 = 370 \text{ pft}$

USE 

AD  
 $370 \times 8 = 2962^{\#}$

USE ADU2

LINE (A) -  $2934^{\#} + 308 \times [3] + 203 \times [8] = 5382^{\#}$   
 (2548<sup>#</sup>)

$5382^{\#} / 2 = 2691^{\#}$

USE D/BL STACKED

D/BL HFX - 24x8 x 1/8 STD.

10" MIN EMBED



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UPPER

LINE (C) -  $5245^{\#} + 203 \times \left[ \frac{22}{2} + \frac{9}{2} \right] = 6361^{\#}$

(1117<sup>#</sup>)

$6361^{\#} / 17 = 374 \text{ psf}$

USE AG

WD

$374 \times 8 = 2993^{\#}$

USE HDU2

LINE (D) -  $203 \times \left[ \frac{9}{2} + \frac{20}{2} \right] = 2944^{\#}$

$2944^{\#} / 20 = 147 \text{ psf}$

USE AG

WD

$147 \times 8 = 1176^{\#}$

00 HD NEGLIGIBLE



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<p>TG</p> <p>Date:</p> <p>8/4/09</p>	<p>Structural Calculations for:</p> <p>Williams Residence</p> <p>20680 Mockingbird Rd Bodega Bay, CA</p>	<p>Job #09018</p> <p>43 of 58</p>
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UPPER

LINE (E) -  $203 \times \left[ \frac{24}{2} + 8 \right] = 4060^{\#}$

$\frac{4060^{\#}}{8} = 507 \text{ pcf}$

USE (A4)

H2  
 $507 \times 8 = 4060^{\#}$

(USE HDUS)

LINE (F) -  $3315^{\#} + 308 \times [5] + 203 \times [5] = 5870^{\#}$   
(2555<sup>#</sup>)

$\frac{5870^{\#}}{4} = 1467 \text{ pcf}$

USE (A3/A3)

H0  
 $1467 \times 8 = 11740^{\#}$

(USE HADQ11)

LINE (G) -  $308 \times [5] + 203 \times [7] = 2961^{\#}$

$\frac{2961^{\#}}{20} = 150 \text{ pcf}$

SEE MF#1 ANALYSIS



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TG	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	Job #09018  44 of 50
Date: 8/4/09		

Type	Sheathing/ Nailing	$v$ allowable (seismic)	$v$ allowable (wind)
B6	3/8" ply w/ 8d @ 6" o.c.	220 plf	300 plf
B3	3/8" ply w/ 8d @ 3" o.c.	410 plf	570 plf
B2	3/8" ply w/ 8d @ 2" o.c. See notes C&D below	530 plf	740 plf
A6	15/32" ply w/ 10d @ 6"	310 plf	434 plf *values reduced for 10d x 2 1/2" long
A4	15/32" ply w/ 10d @ 4"	460 plf	644 plf *values reduced for 10d x 2 1/2" long
A3	15/32" ply w/ 10d @ 3" o.c. See note C, D	600 plf	846 plf *values reduced for 10d x 2 1/2" long
A2	15/32" ply w/ 10d @ 2" o.c. See note C, D	770 plf	1078 plf *values reduced for 10d x 2 1/2" long
A3/A2	15/32" ply each side. w/ 10d @ 3" o.c. See notes B&D below	1020 plf	1428 plf *values reduced for 10d x 2 1/2" long
A2/A2	15/32" ply each side w/ 10d @ 2" See notes B, C&D below	1308 plf	1832 plf *values reduced for 10d x 2 1/2" long

### Typical Notes

1. Studs shall be @ 24" o.c. max
2. Field nailing for all plywood shall be 12" o.c.
3. Block and nail all plywood edges.
4. All plywood shall be spliced at centerline of framing or blocking. (See detail 5/S1, 6/S1 and 7/S1).
5. See detail 10/S1 for shear wall types.
6. See "wall bracing" note in General Structural Notes for general requirements.
7. For holdown detail see 8/S1.

### Special Notes

- A. tables based on 8d (.131) or 8d (.113) galv. box x 2 1/2" and 10d (.148) or 10d (.128) galv. box x 2 1/2" see framing per notes C and D.
- B. Panel joints for double sided walls shall be offset to fall on different framing members use 4x framing per notes C and D.
- C. Stagger rows of nails at plywood edges. 4x required
- D. At plywood joints, Stagger rows of nails use 4x minimum studs or blocking.
- E. Applies to nailing at all studs, top and bottom plates and blocking.

Anchor	Sill Parallel		Anchor Bolt Spacing (plf)						
Bolt	Plate	Bolt Value / x 1.33	8"	12"	16"	24"	32"	48"	
5/8"	2x	880 / 1170	1755	1170	880	585	438	292	
	3x	1130 / 1502	2253	1502	1130	751	563	375	
3/4"	2x	1210 / 1609	2413	1609	1210	805	603	402	
	3x	1460 / 1942	2913	1942	1460	971	728	486	

- A. No reduction for Pressure Treatment has been taken in accordance with [2306.1.3]
- B. Values are for sole plates provided with a min. .25" x 3" sq. washer



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TG	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	Job #09018  45 of 58
Date: 8/4/09		

### Global

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation	Yes
Include Warping	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Vertical Axis	Y

Hot Rolled Steel Code	AISC: ASD 9th
Cold Formed Steel Code	AISI 99: ASD
NDS Wood Code	NDS 91: ASD
NDS Temperature	< 100F
Concrete Code	ACI 1999

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections	Yes
Bad Framing Warnings	No
Unused Force Warnings	Yes

### Hot Rolled Steel Properties

Label	E [ksi]	G [ksi]	Nu	Therm (1E5 F)	Density[k/ft^3]	Yield[ksi]
TUBE	29000	11154	.3	.65	.49	46
STEEL	29000	11154	.3	.65	.49	50

### Member Primary Data

Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Design List	Type	Material	Design Rules
M1	N1	N3			W12X35	WF 12	Column	STEEL	Typical
M2	N3	N5			W12X35	WF 12	Column	STEEL	Typical
M3	N2	N4			W12X35	WF 12	Column	STEEL	Typical
M4	N4	N6			W12X35	WF 12	Column	STEEL	Typical
M5	N3	N4			W12X35	Wide Flange	Beam	STEEL	Typical
M6	N5	N6			W12X35	Wide Flange	Beam	STEEL	Typical

### Joint Coordinates and Temperatures

Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diaph...
N1	0	0	0	0	
N2	20	5	0	0	



TG	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	Job #09018  46 of 58
Date: 8/4/09		

**Joint Coordinates and Temperatures (Continued)**

Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diaph...
N3	0	9	0	0	
N4	20	9	0	0	
N5	0	23	0	0	
N6	20	23	0	0	

**Joint Boundary Conditions**

Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]
N1	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction
N2	Reaction	Reaction	Reaction	Reaction	Reaction	Reaction

**Hot Rolled Steel Design Parameters**

Label	Shape	Length[ft]	Lbyy[ft]	Lbzz[ft]	Lcomp top[ft]	Lcomp bot[ft]	Kyy	Kzz	Cm-yy	Cm-zz	Cb	y sway	z sway
M1	W12X35	9											
M2	W12X35	14											
M3	W12X35	4											
M4	W12X35	14											
M5	W12X35	20											
M6	W12X35	20											

**Member Point Loads**

Member Label	Direction	Magnitude[k,k-ft]	Location[ft,%]
No Data to Print ...			

**Member Distributed Loads**

Member Label	Direction	Start Magnitude[k/ft,d...]	End Magnitude[k/ft,deg]	Start Location[ft,%]	End Location[ft,%]
No Data to Print ...					

**Basic Load Cases**

BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed Area (Me...	Surface (P...
DEAD	DL		-1				2	
ROOF LIVE	LL		-1				1	
LIVE	LL		-1				1	
WIND	WL	-1					2	
EQ	EL	-1						



TG  Date: 8/4/09	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	Job #09018  47 of 58
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### Load Combinations

Description	Solve	...	...	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
DEAD	Yes			1	1												
DEAD + LIVE + ROOF L...	Yes			1	1	2	1	3	1								
DEAD + LIVE + WIND	Yes			1	1	3	1	4	1								
DEAD + LIVE + E	Yes			1	1	3	1	5	1								
1.2DEAD +.5 LIVE + E ...	Yes			1	1.2	3	.5	5	3								

### Envelope Joint Displacements

Joint		X [in]	lc	Y [in]	lc	Z [in]	lc	X Rotation [...]	lc	Y Rotation [...]	lc	Z Rotation [...]	lc
N1	max	0	1	0	1	0	1	0	1	0	1	0	5
	min	0	5	0	2	0	1	0	1	0	1	0	3
N2	max	0	3	0	1	0	1	0	1	0	1	0	5
	min	0	5	0	3	0	1	0	1	0	1	0	3
N3	max	.032	3	-.003	1	0	1	0	1	0	1	1.119e-4	5
	min	-.051	5	-.005	2	0	1	0	1	0	1	-1.406e-3	3
N4	max	.028	3	-.001	1	0	1	0	1	0	1	1.537e-3	5
	min	-.049	5	-.002	3	0	1	0	1	0	1	-2.513e-4	3
N5	max	.311	3	-.003	1	0	1	0	1	0	1	6.541e-4	5
	min	-.271	5	-.007	2	0	1	0	1	0	1	-1.077e-3	3
N6	max	.31	3	-.002	5	0	1	0	1	0	1	7.556e-4	5
	min	-.272	5	-.005	3	0	1	0	1	0	1	-9.511e-4	3

### Envelope Joint Reactions

Joint		X [k]	lc	Y [k]	lc	Z [k]	lc	MX [k-ft]	lc	MY [k-ft]	lc	MZ [k-ft]	lc
N1	max	3.342	5	15.177	2	0	1	0	1	0	1	-4.047	3
	min	1.464	1	7.141	1	0	1	0	1	0	1	-14.333	5
N2	max	5.175	5	15.309	3	0	1	0	1	0	1	22.015	3
	min	-9.157	3	6.917	1	0	1	0	1	0	1	-32.129	5
Totals:	max	8.517	5	29.737	2	0	1						
	min	-6.161	3	14.059	1	0	1						

### Envelope Member Section Forces

Member	Sec		Axial[k]	lc	y Shear[k]	lc	z Shear[k]	lc	Torque[k-ft]	lc	y-y Moment...	lc	z-z Momen...	lc
M1	1	max	15.177	2	-1.464	1	0	1	0	1	0	1	-4.047	3
		min	7.141	1	-3.342	5	0	1	0	1	0	1	-14.333	5
	2	max	14.941	2	-1.464	1	0	1	0	1	0	1	2.606	3
		min	7.063	1	-3.105	5	0	1	0	1	0	1	-7.08	5
	3	max	14.704	2	-1.464	1	0	1	0	1	0	1	9.082	3
		min	6.984	1	-2.975	4	0	1	0	1	0	1	-359	5
	4	max	14.468	2	-1.464	1	0	1	0	1	0	1	15.38	3



TG	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	Job #09018  <div style="font-size: 2em; font-family: cursive;">48 of 58</div>
Date: 8/4/09		

### Envelope Member Section Forces (Continued)

Member	Sec		Axial[k]	lc	y Shear[k]	lc	z Shear[k]	lc	Torque[k-ft]	lc	y-y Moment...	lc	z-z Momen...	lc
		min	6.905	1	-2.897	4	0	1	0	1	0	1	5.412	1
	5	max	14.231	2	-1.464	1	0	1	0	1	0	1	21.501	3
		min	6.826	1	-2.818	4	0	1	0	1	0	1	8.706	1
M2	1	max	4.531	2	1.099	3	0	1	0	1	0	1	7.491	3
		min	1.018	3	-3.725	5	0	1	0	1	0	1	-24.862	5
	2	max	4.163	2	1.222	3	0	1	0	1	0	1	3.429	3
		min	.773	3	-3.357	5	0	1	0	1	0	1	-12.469	5
	3	max	3.795	2	1.344	3	0	1	0	1	0	1	-1.01	1
		min	.528	3	-2.989	5	0	1	0	1	0	1	-2.353	4
	4	max	3.427	2	1.467	3	0	1	0	1	0	1	8.452	5
		min	.282	3	-2.621	5	0	1	0	1	0	1	-5.982	3
	5	max	3.059	2	1.59	3	0	1	0	1	0	1	16.981	5
		min	.037	3	-2.253	5	0	1	0	1	0	1	-11.332	3
M3	1	max	15.309	3	9.157	3	0	1	0	1	0	1	22.015	3
		min	6.917	1	-5.175	5	0	1	0	1	0	1	-32.129	5
	2	max	15.239	3	9.192	3	0	1	0	1	0	1	12.84	3
		min	6.882	1	-5.07	5	0	1	0	1	0	1	-27.007	5
	3	max	15.169	3	9.228	3	0	1	0	1	0	1	3.63	3
		min	6.847	1	-4.965	5	0	1	0	1	0	1	-21.99	5
	4	max	15.099	3	9.263	3	0	1	0	1	0	1	-5.615	3
		min	6.812	1	-4.859	5	0	1	0	1	0	1	-17.078	5
	5	max	15.029	3	9.298	3	0	1	0	1	0	1	-8.218	1
		min	6.777	1	-4.754	5	0	1	0	1	0	1	-15.762	2
M4	1	max	4.516	2	3.219	3	0	1	0	1	0	1	26.543	3
		min	1.501	5	-1.322	5	0	1	0	1	0	1	-2.616	5
	2	max	4.148	2	3.341	3	0	1	0	1	0	1	15.064	3
		min	1.293	5	-.954	5	0	1	0	1	0	1	1.368	5
	3	max	3.856	3	3.464	3	0	1	0	1	0	1	4.064	5
		min	1.084	5	-.586	5	0	1	0	1	0	1	1.091	1
	4	max	3.61	3	3.587	3	0	1	0	1	0	1	5.471	5
		min	.876	5	-.218	5	0	1	0	1	0	1	-9.183	3
	5	max	3.365	3	3.709	3	0	1	0	1	0	1	5.591	5
		min	.667	5	.15	5	0	1	0	1	0	1	-21.951	3
M5	1	max	3.78	3	9.784	4	0	1	0	1	0	1	36.348	5
		min	-1.329	5	4.981	1	0	1	0	1	0	1	14.01	3
	2	max	4.355	3	5.399	5	0	1	0	1	0	1	-.804	5
		min	-1.855	5	2.501	1	0	1	0	1	0	1	-14.049	3
	3	max	4.93	3	1.335	5	0	1	0	1	0	1	-10.279	1
		min	-2.381	5	-1.371	3	0	1	0	1	0	1	-19.955	2
	4	max	5.504	3	-2.46	1	0	1	0	1	0	1	-.335	3
		min	-2.906	5	-6.027	3	0	1	0	1	0	1	-14.151	5
	5	max	6.079	3	-4.94	1	0	1	0	1	0	1	41.438	3
		min	-3.432	5	-10.682	3	0	1	0	1	0	1	9.655	5
M6	1	max	2.253	5	3.059	2	0	1	0	1	0	1	16.981	5
		min	-1.59	3	.037	3	0	1	0	1	0	1	-11.332	3



TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd	49 of 58
	Bodega Bay, CA	

**Envelope Member Section Forces (Continued)**

Member	Sec		Axial[k]	lc	y Shear[k]	lc	z Shear[k]	lc	Torque[k-ft]	lc	y-y Moment...	lc	z-z Momen...	lc
	2	max	1.727	5	2.027	5	0	1	0	1	0	1	4.603	5
		min	-.265	3	-.814	3	0	1	0	1	0	1	-9.39	3
	3	max	1.489	2	1.129	5	0	1	0	1	0	1	-2.792	1
		min	.716	1	-1.664	3	0	1	0	1	0	1	-6.546	2
	4	max	2.384	3	.231	5	0	1	0	1	0	1	7.251	3
		min	.676	5	-2.515	3	0	1	0	1	0	1	-6.683	5
	5	max	3.709	3	-.667	5	0	1	0	1	0	1	21.951	3
		min	.15	5	-3.365	3	0	1	0	1	0	1	-5.591	5

**Envelope Member Section Stresses**

Member	Sec		Axial[ksi]	lc	y Shear[k...]	lc	z Shear[k...]	lc	y-Top[ksi]	lc	y-Bot[ksi]	lc	z-Top[ksi]	lc	z-Bot[ksi]	lc
M1	1	max	1.474	2	-.39	1	0	1	3.772	5	-1.065	3	0	1	0	1
		min	.693	1	-.891	5	0	1	1.065	3	-3.772	5	0	1	0	1
	2	max	1.451	2	-.39	1	0	1	1.863	5	.686	3	0	1	0	1
		min	.686	1	-.828	5	0	1	-.686	3	-1.863	5	0	1	0	1
	3	max	1.428	2	-.39	1	0	1	.094	5	2.39	3	0	1	0	1
		min	.678	1	-.793	4	0	1	-2.39	3	-.094	5	0	1	0	1
	4	max	1.405	2	-.39	1	0	1	-1.424	1	4.047	3	0	1	0	1
		min	.67	1	-.772	4	0	1	-4.047	3	1.424	1	0	1	0	1
	5	max	1.382	2	-.39	1	0	1	-2.291	1	5.658	3	0	1	0	1
		min	.663	1	-.751	4	0	1	-5.658	3	2.291	1	0	1	0	1
M2	1	max	.44	2	.293	3	0	1	6.543	5	1.971	3	0	1	0	1
		min	.099	3	-.993	5	0	1	-1.971	3	-6.543	5	0	1	0	1
	2	max	.404	2	.326	3	0	1	3.281	5	.902	3	0	1	0	1
		min	.075	3	-.895	5	0	1	-.902	3	-3.281	5	0	1	0	1
	3	max	.368	2	.359	3	0	1	.619	4	-.266	1	0	1	0	1
		min	.051	3	-.797	5	0	1	.266	1	-.619	4	0	1	0	1
	4	max	.333	2	.391	3	0	1	1.574	3	2.224	5	0	1	0	1
		min	.027	3	-.699	5	0	1	-2.224	5	-1.574	3	0	1	0	1
	5	max	.297	2	.424	3	0	1	2.982	3	4.469	5	0	1	0	1
		min	.004	3	-.601	5	0	1	-4.469	5	-2.982	3	0	1	0	1
M3	1	max	1.486	3	2.442	3	0	1	8.455	5	5.793	3	0	1	0	1
		min	.672	1	-1.38	5	0	1	-5.793	3	-8.455	5	0	1	0	1
	2	max	1.48	3	2.451	3	0	1	7.107	5	3.379	3	0	1	0	1
		min	.668	1	-1.352	5	0	1	-3.379	3	-7.107	5	0	1	0	1
	3	max	1.473	3	2.461	3	0	1	5.787	5	.955	3	0	1	0	1
		min	.665	1	-1.324	5	0	1	-.955	3	-5.787	5	0	1	0	1
	4	max	1.466	3	2.47	3	0	1	4.494	5	-1.478	3	0	1	0	1
		min	.661	1	-1.296	5	0	1	1.478	3	-4.494	5	0	1	0	1
	5	max	1.459	3	2.479	3	0	1	4.148	2	-2.163	1	0	1	0	1
		min	.658	1	-1.268	5	0	1	2.163	1	-4.148	2	0	1	0	1
M4	1	max	.438	2	.858	3	0	1	.688	5	6.985	3	0	1	0	1
		min	.146	5	-.353	5	0	1	-6.985	3	-.688	5	0	1	0	1



TG  Date: 8/4/09	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	Job #09018  50 of 68
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### Envelope Member Section Stresses (Continued)

Member	Sec		Axial[ksi]	lc	y Shear[k...]	lc	z Shear[k...]	lc	y-Top[ksi]	lc	y-Bot[ksi]	lc	z-Top[ksi]	lc	z-Bot[ksi]	lc
	2	max	.403	2	.891	3	0	1	-.36	5	3.964	3	0	1	0	1
		min	.126	5	-.254	5	0	1	-3.964	3	.36	5	0	1	0	1
	3	max	.374	3	.924	3	0	1	-.287	1	1.069	5	0	1	0	1
		min	.105	5	-.156	5	0	1	-1.069	5	.287	1	0	1	0	1
	4	max	.351	3	.956	3	0	1	2.417	3	1.44	5	0	1	0	1
		min	.085	5	-.058	5	0	1	-1.44	5	-2.417	3	0	1	0	1
	5	max	.327	3	.989	3	0	1	5.777	3	1.471	5	0	1	0	1
		min	.065	5	.04	5	0	1	-1.471	5	-5.777	3	0	1	0	1
M5	1	max	.367	3	2.609	4	0	1	-3.687	3	9.565	5	0	1	0	1
		min	-.129	5	1.328	1	0	1	-9.565	5	3.687	3	0	1	0	1
	2	max	.423	3	1.44	5	0	1	3.697	3	-.212	5	0	1	0	1
		min	-.18	5	.667	1	0	1	.212	5	-3.697	3	0	1	0	1
	3	max	.479	3	.356	5	0	1	5.251	2	-2.705	1	0	1	0	1
		min	-.231	5	-.366	3	0	1	2.705	1	-5.251	2	0	1	0	1
	4	max	.534	3	-.656	1	0	1	3.724	5	-.088	3	0	1	0	1
		min	-.282	5	-1.607	3	0	1	.088	3	-3.724	5	0	1	0	1
	5	max	.59	3	-1.317	1	0	1	-2.541	5	10.905	3	0	1	0	1
		min	-.333	5	-2.849	3	0	1	-10.905	3	2.541	5	0	1	0	1
M6	1	max	.219	5	.816	2	0	1	2.982	3	4.469	5	0	1	0	1
		min	-.154	3	.01	3	0	1	-4.469	5	-2.982	3	0	1	0	1
	2	max	.168	5	.54	5	0	1	2.471	3	1.211	5	0	1	0	1
		min	-.026	3	-.217	3	0	1	-1.211	5	-2.471	3	0	1	0	1
	3	max	.145	2	.301	5	0	1	1.723	2	-.735	1	0	1	0	1
		min	.07	1	-.444	3	0	1	.735	1	-1.723	2	0	1	0	1
	4	max	.231	3	.062	5	0	1	1.759	5	1.908	3	0	1	0	1
		min	.066	5	-.671	3	0	1	-1.908	3	-1.759	5	0	1	0	1
	5	max	.36	3	-.178	5	0	1	1.471	5	5.777	3	0	1	0	1
		min	.015	5	-.897	3	0	1	-5.777	3	-1.471	5	0	1	0	1

### Envelope Member Section Deflections

Member	Sec		x [in]	lc	y [in]	lc	z [in]	lc	x Rotate [ra...]	lc	(n) L/y Ratio	lc	(n) L/z Ratio	lc
M1	1	max	0	1	0	1	0	1	0	1	NC	1	NC	1
		min	0	1	0	1	0	1	0	1	NC	1	NC	1
	2	max	0	1	.008	5	0	1	0	1	NC	5	NC	1
		min	-.001	2	.003	1	0	1	0	1	NC	1	NC	1
	3	max	-.001	1	.024	5	0	1	0	1	4472.348	5	NC	1
		min	-.003	2	.003	3	0	1	0	1	NC	3	NC	1
	4	max	-.002	1	.04	5	0	1	0	1	2671.998	5	NC	1
		min	-.004	2	-.006	3	0	1	0	1	NC	3	NC	1
	5	max	-.003	1	.051	5	0	1	0	1	2135.822	5	NC	1
		min	-.005	2	-.032	3	0	1	0	1	3391.609	3	NC	1
M2	1	max	-.003	1	.051	5	0	1	0	1	NC	5	NC	1
		min	-.005	2	-.032	3	0	1	0	1	NC	3	NC	1



TG  Date: 8/4/09	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	Job #09018  51 of 58
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### Envelope Member Section Deflections (Continued)

Member	Sec		x [in]	lc	y [in]	lc	z [in]	lc	x Rotate [ra...]	lc	(n) L/y Ratio	lc	(n) L/z Ratio	lc
	2	max	-.003	1	.085	5	0	1	0	1	4885.882	5	NC	1
		min	-.006	2	-.1	3	0	1	0	1	NC	3	NC	1
	3	max	-.003	1	.152	5	0	1	0	1	1663.704	5	NC	1
		min	-.006	2	-.177	3	0	1	0	1	NC	3	NC	1
	4	max	-.003	1	.222	5	0	1	0	1	980.487	5	NC	1
		min	-.007	2	-.252	3	0	1	0	1	NC	3	NC	1
	5	max	-.003	1	.271	5	0	1	0	1	762.475	5	NC	1
		min	-.007	2	-.311	3	0	1	0	1	NC	3	NC	1
M3	1	max	0	1	0	1	0	1	0	1	NC	1	NC	1
		min	0	1	0	1	0	1	0	1	NC	1	NC	1
	2	max	0	1	.005	5	0	1	0	1	NC	5	NC	1
		min	0	3	-.005	3	0	1	0	1	9851.838	3	NC	1
	3	max	0	1	.015	5	0	1	0	1	3175.255	5	NC	1
		min	-.001	3	-.012	3	0	1	0	1	3862.165	3	NC	1
	4	max	0	1	.03	5	0	1	0	1	1594.743	5	NC	1
		min	-.002	3	-.021	3	0	1	0	1	2314.073	3	NC	1
	5	max	-.001	1	.049	5	0	1	0	1	986.572	5	NC	1
		min	-.002	3	-.028	3	0	1	0	1	1721.513	3	NC	1
M4	1	max	-.001	1	.049	5	0	1	0	1	NC	5	NC	1
		min	-.002	3	-.028	3	0	1	0	1	NC	3	NC	1
	2	max	-.001	1	.115	5	0	1	0	1	NC	5	NC	1
		min	-.003	3	-.071	3	0	1	0	1	3862.941	3	NC	1
	3	max	-.002	1	.179	5	0	1	0	1	9024.376	5	NC	1
		min	-.004	3	-.153	3	0	1	0	1	1338.973	3	NC	1
	4	max	-.002	1	.232	5	0	1	0	1	NC	5	NC	1
		min	-.004	3	-.243	3	0	1	0	1	779.81	3	NC	1
	5	max	-.002	5	.272	5	0	1	0	1	NC	5	NC	1
		min	-.005	3	-.31	3	0	1	0	1	596.182	3	NC	1
M5	1	max	.032	3	-.003	1	0	1	0	1	NC	1	NC	1
		min	-.051	5	-.005	2	0	1	0	1	NC	2	NC	1
	2	max	.031	3	-.042	1	0	1	0	1	6028.406	1	NC	1
		min	-.05	5	-.093	3	0	1	0	1	2681.099	3	NC	1
	3	max	.03	3	-.066	1	0	1	0	1	3736.027	1	NC	1
		min	-.05	5	-.128	2	0	1	0	1	1928.637	2	NC	1
	4	max	.029	3	-.042	1	0	1	0	1	5949.037	1	NC	1
		min	-.049	5	-.092	5	0	1	0	1	2686.296	5	NC	1
	5	max	.028	3	-.001	1	0	1	0	1	NC	1	NC	1
		min	-.049	5	-.002	3	0	1	0	1	NC	3	NC	1
M6	1	max	.311	3	-.003	1	0	1	0	1	NC	1	NC	1
		min	-.271	5	-.007	2	0	1	0	1	NC	2	NC	1
	2	max	.31	3	-.002	5	0	1	0	1	NC	5	NC	1
		min	-.271	5	-.037	3	0	1	0	1	7293.156	3	NC	1
	3	max	.31	3	-.02	1	0	1	0	1	NC	1	NC	1
		min	-.271	5	-.048	2	0	1	0	1	5734.736	2	NC	1
	4	max	.31	3	.006	3	0	1	0	1	NC	3	NC	1



TG	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	Job #09018
Date: 8/4/09		52 of 50

**Envelope Member Section Deflections (Continued)**

Member	Sec	x [in]	lc	y [in]	lc	z [in]	lc	x Rotate [ra...	lc	(n) L/y Ratio	lc	(n) L/z Ratio	lc	
		min	-272	5	-032	2	0	1	0	1	9055.398	2	NC	1
	5	max	.31	3	-.002	5	0	1	0	1	NC	5	NC	1
		min	-.272	5	-.005	3	0	1	0	1	NC	3	NC	1

**Envelope ASD Steel Code Checks**

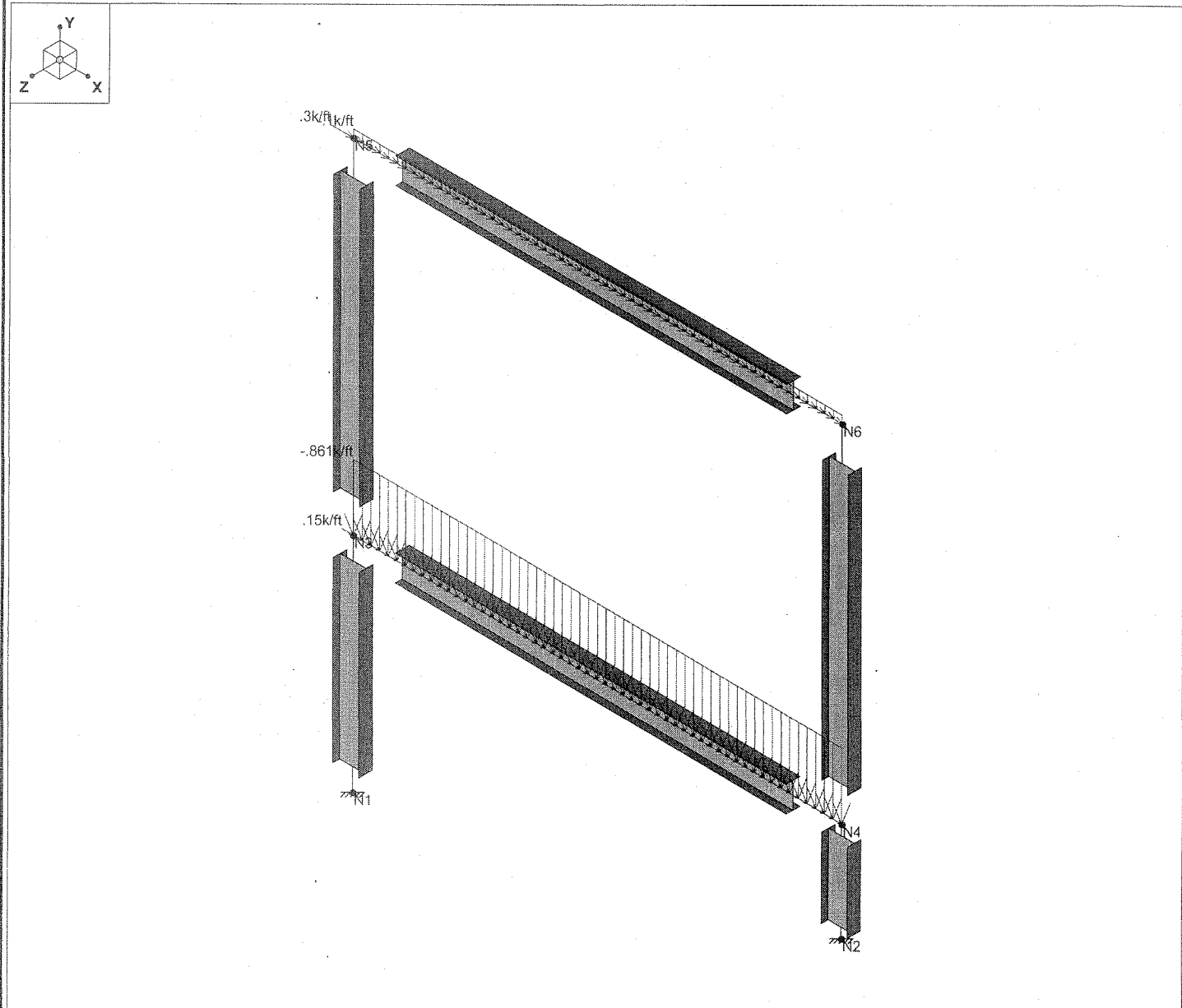
Member	Shape	Code Check	Loc[ft]	lc	Shear ... Loc[ft]	Dir	lc	Fa [ksi]	Ft [ksi]	Fb y-y ...	Fb z-z ...	Cb	Cmy	Cmz	ASD E...	
M1	W12X35	.192	9	2	.037	0	y	2	20.933	30	37.5	30	2.3	.6	.394	H1-2
M2	W12X35	.122	0	4	.020	0	y	4	16.738	39.9	49.875	39.9	2.3	.6	.85	H1-3
M3	W12X35	.171	4	2	.093	4	y	3	27.013	30	37.5	33	1.0	.6	.715	H1-2
M4	W12X35	.200	0	3	.037	14	y	3	16.738	39.9	49.875	39.9	2.3	.6	.85	H1-3
M5	W12X35	.552	0	2	.129	0	y	2	6.167	30	37.5	13.812	1.0	.6	.85	H1-2
M6	W12X35	.189	20	3	.041	0	y	2	8.202	39.9	49.875	39.9	2.3	.6	.85	H1-3

**Material Takeoff**

Material	Size	Pieces	Length[ft]	Weight[K]
Hot Rolled Steel				
STEEL	W12X35	6	81	2.8
Total HR Steel		6	81	2.8



TG	Structural Calculations for:	Job #09018
Date:	<b>Williams Residence</b>	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	53 of 58



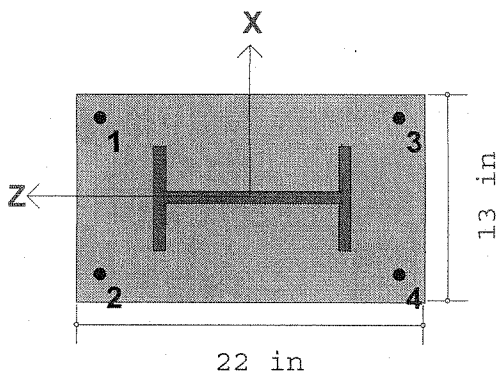
Loads: LC 3, DEAD + LIVE + WIND  
Solution: Envelope

Green Engineering	WILLIAMS RESIDENCE	
TODD E. GREEN P.E.		Aug 24, 2009 at 10:25 AM
09018		WILLIAMSMP 1.r3d



TG	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Bodega Bay, CA	Job #09018
Date: 8/4/09		54 of 60

## WILLIAMS RESIDENCE

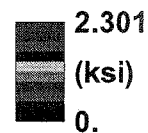
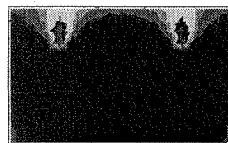


### Plain Base Plate Connection

- Base Plate Thickness : 1.5 in
- Base Plate Fy : 50. ksi
- Bearing Surface Fp : 1.75 ksi
- Anchor Bolt Diameter : .75 in
- Anchor Bolt Material : A36
- Anchor Bolt Fu : 58. ksi
- Column Shape : W12X35
- Design Code : AISC ASD 9th

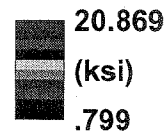
### Bearing Pressure

Maximum Bearing : 2.301 ksi  
Max/Allowable Ratio : .986 UBC (12-13)  
(ABIF = 1.333)



### Base Plate Stress

Maximum Stress : 20.869 ksi  
Max/Allowable Ratio : .417 UBC (12-13)  
(ASIF = 1.333)



### Anchor Bolts

Bolt	X (in)	Z (in)	Tens.(k)	Vx (k)	Vz (k)	Ft (ksi)	Fv (ksi)	Unity	Combination
1	5.	9.5	17.87	0.	2.25	24.078	13.197	1.68	UBC (12-13)
2	-5.	9.5	17.87	0.	-2.25	24.078	13.197	1.68	UBC (12-13)
3	5.	-9.5	17.87	0.	2.25	24.078	13.197	1.68	UBC (12-13)
4	-5.	-9.5	17.87	0.	-2.25	24.078	13.197	1.68	UBC (12-13)

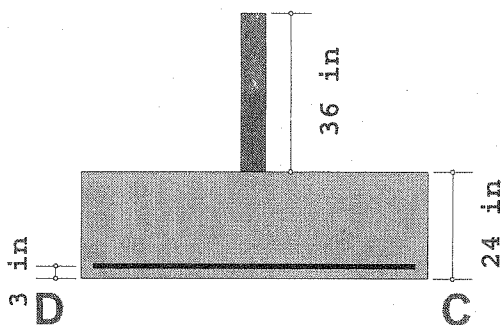
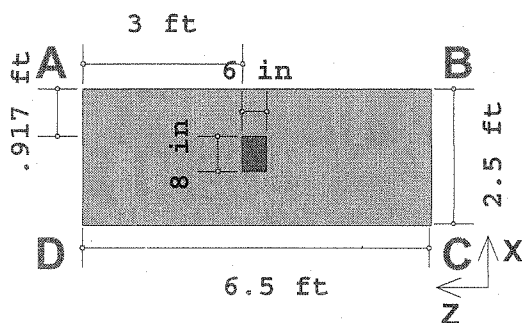
### Loads

	P (k)	Vx (k)	Vz (k)	Mx (k-ft)	Mz (k-ft)	Reverse
DL	7.					No
LL	7.					No
EL			9.		32.	Yes



TG	Structural Calculations for:	Job #09018
Date:	Williams Residence	
8/4/09	20680 Mockingbird Rd Bodega Bay, CA	55 of 58

## WILLIAMS



Allowable Soil Bearing : 1500 psf  
Concrete Weight : 145 pcf  
Concrete f'c : 2.5 ksi  
Steel fy : 60 ksi

### Service Soil Bearing

Maximum Bearing 1996.87 psf DL+LL+EL  
Max/Allowable Ratio .999 (ABIF = 1.333)

A B 1996.87 psf  
D C 519.949 psf

### Flexure Design

Maximum Mu<sub>XX</sub> /  $\phi$  26.675 k-ft ACI 9.2(E)  
Maximum Mu<sub>ZZ</sub> /  $\phi$  5.738 k-ft ACI 9.1

A B  $\updownarrow$  X Dir. Steel: 3.37 in<sup>2</sup> (min)  
D C  $\rightleftarrows$  Z Dir. Steel: 1.296 in<sup>2</sup> (min)

X direction steel requires the following placement:

Region 1 (starts at A): 24 in Steel: .749 in<sup>2</sup>  
Region 2 (middle): 30 in Steel: 1.872 in<sup>2</sup>  
Region 3 (ends at B): 24 in Steel: .749 in<sup>2</sup>

### Maximum Shear Check Ratios (Vu / $\phi$ Vc)

Two Way (Punching) Shear NA  
One Way Shear, X dir. cut .131 ACI 9.2(E)  
One Way Shear, Z dir. cut 0 ACI 9.1

### Overtuning Moment Safety Factors (OTM SF)

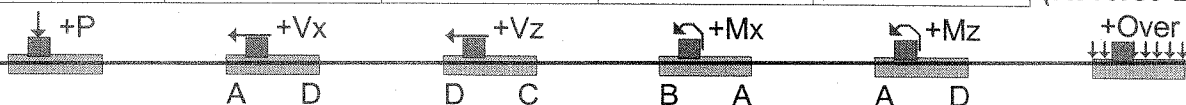
OTM SF About X-X Axis 5.112 DL+LL+EL  
OTM SF About Z-Z Axis NA DL+LL

### Concrete Bearing (For Vertical Loads Only!)

Maximum Bu /  $\phi$  43.898 k ACI 9.1  
Allowable Bc 204 k

### Loads

	P (k)	Vx (k)	Vz (k)	Mx (k-ft)	Mz (k-ft)	Overburden (psf)
DL	7					100
LL	7					
EL			9	32		(Reverse EL)





<p>TG</p> <p>Date:</p> <p>8/4/09</p>	<p>Structural Calculations for:</p> <p><b>Williams Residence</b></p> <p>20680 Mockingbird Rd Bodega Bay, CA</p>	<p>Job #09018</p> <p>56 of 58</p>
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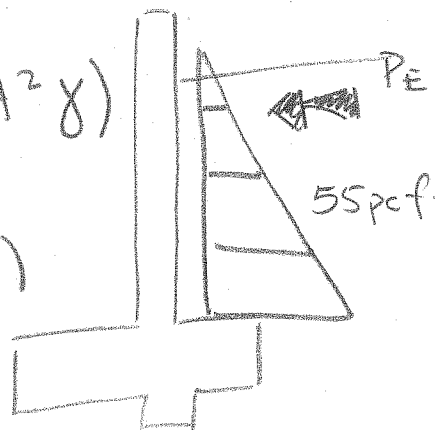
EQUIVALENT PSEUDO-STATIC FORCE

$$P_E = .5 (K_A)^{.5} (g_{max}/g) (H^2 \gamma)$$

$$= .5 (.6)^{.5} (.4) (120) (H^2)$$

$$= 18.6 H^2$$

USE 19 H<sup>2</sup>



4 ft

$$P_A = \frac{55(4)^2}{2} = 440 @ 1.32'$$

$$P_E = \frac{19(4)^2}{2} = \frac{304 @ 2.69'}{744 \#}$$

$$\frac{1395 \# \cdot ft}{1.32} = 1049 \# \quad \text{or} \quad \frac{(1048)(2)}{42}$$

USE Q<sub>TOT</sub> = 131 pcf

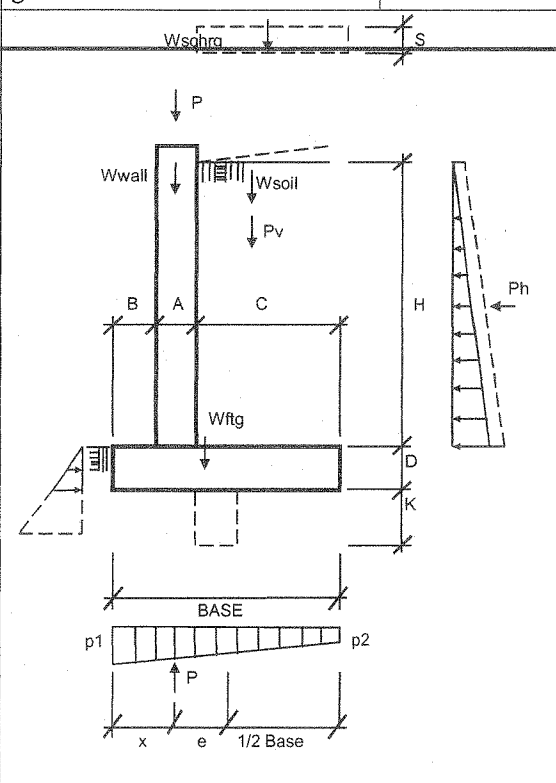


TG  Date: 8/4/09	Structural Calculations for: <b>Williams Residence</b> 20680 Mockingbird Rd Dodega Bay, CA	Job #09018  57 of 58
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**CONCRETE RETAINING WALL SUMMARY**  
 H = 5 FT. SLOPED BACKFILL  
 EFP = 131 PCF 0 FT SURCHARGE

WALL HEIGHT	5 FT.
CONC DENSITY	150 PCF
SOIL DENSITY	100 PCF
E.F.P. =	131 PCF
PASSIVE PRESSURE	350 PCF
FRICION COEFF	0.35
BACKFILL ANGLE	27 DEG
DEPTH SURCHARGE (S)	0 FT.
P =	0.5 KIPS
A =	0.67 FT.
B =	2.00 FT.
C =	1.33 FT.
D =	1.00 FT.
K =	3.00 FT.
BASE	4.00 FT.

ITEM	WT	ARM	MOMENT
W wall	0.5	2.34	1.2
W ftg	0.6	2.00	1.2
W soil	0.7	3.34	2.2
W schrg	0.0	3.34	0.0
P	0.5	2.34	1.2
Pv	1.2	3.34	4.0
<b>TOTALS</b>	<b>3.5</b>		<b>9.8</b>



**OVERTURNING**  
 OTM = 4.7 K-FT    RM = 9.77 K-FT    **FS = 2.07**

**SLIDING**  
 Ph = 2.36 KIP    RH = 4.01 KIP    **FS = 1.70**

x = 1.46 FT.    KERN IN    **p1 = 1.58 KSF**  
 e = 0.54 FT.    **p2 = 0.16 KSF**

DESIGN PARAMETERS			
fc =	2.5 KSI	d WALL =	8.0 IN.
fy =	60 KSI	d FTG =	12.0 IN.

FOOTING TOE	REQUIRED	PROVIDED	WHERE As MIN
Vu = 3.88 K	vu = 32 PSI <	100 PSI	CONTROLS A
Mu = 4.35 KFT	As req = 0.26 IN 2	IN 2	* 0.0018*bd B
		# 4 @ 12 "o.c.	** 200/fy*bd
			*** 1.33As req
<b>FOOTING HEEL</b>			
Vu = 2.89 K	vu = 24 PSI <	100 PSI	
Mu = 1.92 KFT	As req = 0.26 IN 2 >	IN 2	
	PERP As min = 0.26 IN 2 >	IN 2	
		# 4 @ 12 "o.c.	
<b>WALL</b>			
Vu = 2.78 K	vu = 34 PSI <	100 PSI	
Mu = 4.64 KFT	As req = 0.17 IN 2 >	IN 2	
	PERP As min = 0.17 IN 2 >	IN 2	
		# 4 @ 12 "o.c.	



# GREEN ENGINEERING CONSULTING ENGINEERS

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 phone 707 824 0660 fax 707 824 0567  
 www.greenengineering.net

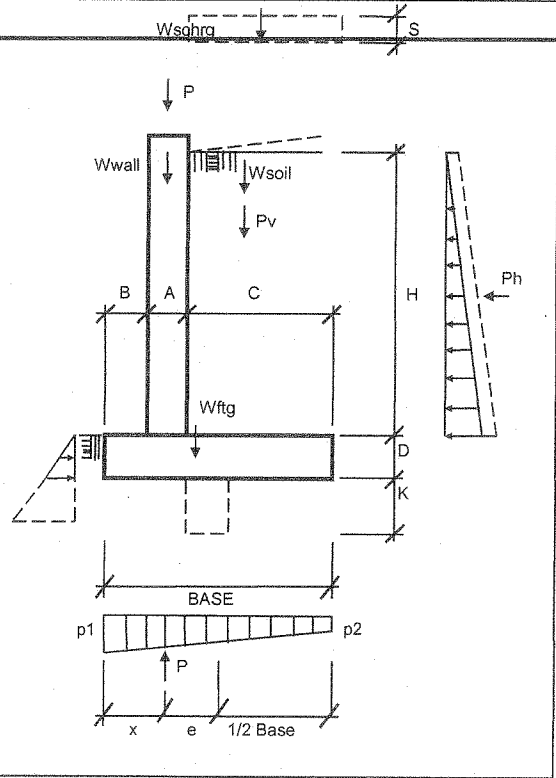
TG	<b>Structural Calculations for:</b> <b>Williams Residence</b> 20680 Mockingbird Rd Redwood Bay, CA	<b>Job #09018</b>  58 of 58
Date: 8/4/09		

**CONCRETE RETAINING WALL SUMMARY**

H = 4 FT. SLOPED BACKFILL  
 EFP = 131 PCF 0 FT SURCHARGE

**WALL HEIGHT** 4 FT.  
**CONC DENSITY** 150 PCF  
**SOIL DENSITY** 100 PCF  
**E.F.P. =** 131 PCF  
**PASSIVE PRESSURE** 350 PCF  
**FRICTION COEFF** 0.35  
**BACKFILL ANGLE** 27 DEG  
**DEPTH SURCHARGE (S)** 0 FT.  
**P =** 0.5 KIPS  
  
**A =** 0.67 FT.  
**B =** 1.33 FT.  
**C =** 1.00 FT.  
**D =** 1.00 FT.  
**K =** 1.00 FT.  
**BASE** 3.00 FT.

ITEM	WT	ARM	MOMENT
W wall	0.4	1.67	0.7
W ftg	0.5	1.50	0.7
W soil	0.4	2.50	1.0
W schrg	0.0	2.50	0.0
P	0.5	1.67	0.8
Pv	0.8	2.50	2.1
<b>TOTALS</b>	<b>2.6</b>		<b>5.3</b>



**OVERTURNING**

OTM = 2.7 K-FT RM = 5.26 K-FT **FS = 1.93**

**SLIDING**  
 P h 1.64 KIP RH = 1.61 KIP **FS = 0.98**

x = 0.98 FT. KERN OUT **p1 = 1.76 KSF**  
 e = 0.52 FT. **p2 = 0.00 KSF**

**DESIGN PARAMETERS**

**f<sub>c</sub> =** 2.5 KSI **d WALL =** 8.0 IN.  
**f<sub>y</sub> =** 60 KSI **d FTG =** 12.0 IN.

FOOTING TOE		REQUIRED	PROVIDED	WHERE AS MIN
Vu =	2.90 K	vu = 24 PSI	< 100 PSI	CONTROLS A
Mu =	2.32 KFT	As req = 0.26 IN 2	IN 2	
			# 4 @ 12 "o.c.	* 0.0018*bd
				** 200/fy*bd
				*** 1.33As req
FOOTING HEEL				
Vu =	1.94 K	vu = 16 PSI	< 100 PSI	
Mu =	0.97 KFT	As req = 0.26 IN 2	> IN 2	
		PERP As min = 0.26 IN 2	> IN 2	
			# 4 @ 12 "o.c.	
WALL				
Vu =	1.78 K	vu = 22 PSI	< 100 PSI	
Mu =	2.38 KFT	As req = 0.17 IN 2	> IN 2	
		PERP As min = 0.17 IN 2	> IN 2	
			# 4 @ 12 "o.c.	