Appendix D. Excel Sheets

Designer: Lindsey Miller	Load Development Calculations	Job Number: 134231055
Checked by:		Date: 2/12/2013

Location

Province	Location
British Columbia:	-
Alberta:	-
Saskatchewan:	-
Manitoba:	-
Ontario:	-
Quebec:	-
New Brunswick:	-
Nova Scotia:	North Sydney
Prince Edward Island:	-
Newfoundland:	-
Yukon:	-
Nothwest Territories:	-
Nunavut:	-

Climatic Data for
North Sydney
From Nova Scotia Building Code: Schedule "B" See Page 2

Snow Load, kPa, 1/50		Hourly Wind Pressures, kPa		Seismic Data(1)				
Ss	Sr	1/10	1/50	Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	PGA
2.4	0.6	0.47	0.59	0.19	0.11	0.06	0.02	0.098

Building Information

Total Height	8	m
Number of Storeys	1	

Designer: Lindsey Miller	**Load Development Calculations**	Job Number: 134231055
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Climactic Data - NSBC Schedule 'B'

Location	Design Temperature				Degree - Days Below 18 °C	15 Min. Rain mm	One Day Rain 1/50 mm	Ann Rain mm	Ann Total Ppn. mm
	January		July 2.5%						
	2.50% °C	1% °C	Dry °C	Wet °C					
North Sydney	-16	-18	27	21	4600	13	123	1200	1475

	Ground Snow Load, kPa		Hourly Wind Pressures		Seismic Data				
	S_s	S_r	10-Jan kPa	1/50 kPa	S_s -0.2	S_s -0.5	S_s -1	S_s -2	PGA
	2.4	0.6	0.47	0.59	0.19	0.11	0.06	0.02	0.098

Designer: Lindsey Miller	Load Development Calculations	Job Number: 134231055
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Dead Load

Roof Loads				
Item	Load		Load	
Insulation	0.1	kpa	2	psf
Concrete	2	kpa	41.77	psf
Decking	1	kpa	20.885	psf
Uplift Scenario	1.2	kpa	25.062	psf
Sum=	4.3	kpa	90	psf
Floor Loads				
Slab on Grade	2	kpa	41.77	psf
Equipment	1	kpa	20.885	psf
Sum=	3	kpa	62.655	psf

Live Load

Floor(s)				
Item/area	Load		Load	
At grade	25	kpa	522.125	psf
Roof	1	kpa	20.885	psf

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Snow Load

Basic Roof

S=Is(Ss(CbCwCsCa) + Sr)

Where

Is=	1.3		Ss=	2.4
Cb=	0.8		Sr=	0.6
Cw=	1.0			
Cs=	1.0			
Ca=	1.0			
S=	3.15	kPa	65.77	psf

Drift?

height difference=		0	m	Gamma=	3.0	kN/m^3		
	hp=	0.6	m					
Not next to another building								
lc=	2w-w^2/l	where	w=	13	m	l=	20	m
lc=	17.55	m						
F=	2							
F=	0.35*(Gamma*lc/Ss-6(Gamma*hp/Ss)^2)^0.5+Cb*Ca=						2.307948	Governs
Xd=	5*(h-Cb*Ss/Gamma)			-3.2	Governs			
Xd=	5*(Ss/Gamma)*(F-Cb)			6.031791				
Ca(0)=	Gamma*h/(Cb*Ss)			0	Governs			
Ca(0)=	F/Cb			2.884935				
So=Is(Ss(CbCwCsCa) + Sr)			0.75	kpa	15.66	psf		

Designer: Lindsey Miller	Load Development Calculations	Job Number: 134231055
Checked by:		Date: 2/12/2013

External Wind Load

P=Iw-q-Ce-Cg-Cp			Height of building=		8	m
Where						
Iw=	1.25		q(1/10)=	0.47	kPa	
Ce=	0.96		q(1/50)=	0.59	kPa	
	Winward	Leeward	Roof Uplift		See Figure I-7 and I-9	
CpCg=	0.75	-0.55	-1.5			
p=	0.53	-0.39	-1.06	kPa		
Roof Check per Fig I-9			Uplift can not be less than			
pex= Iw-q-Ce-CpCg						
where CpCg=		-1.5				
pex=	-1.06	Does Not Govern				

Internal Wind Load

pi=Iw-q-Ce-Cpi-Cgi					
Where					
Iw=	1.25		q(1/10)=	0.47	kPa
Ce=	0.96		q(1/50)=	0.59	kPa
Cpi=	0.7				
Cgi=	2				
pi=	0.99				

Summary Wind Loads

	Windward		Leeward		Roof Uplift	
p=	1.52	kPa	-1.38	kPa	-2.05	kPa

Designer: Lindsey Miller	Load Development Calculations	Job Number: 134231055
Checked by:		Date: 2/12/2013

Seismic Load

Climatic Data

Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	PGA
0.19	0.11	0.06	0.02	0.098

Class of Soil	C
Fa=	1
Fv=	1
Ie=	1.5

Cl 4.1.8.7

Ie-Fa-Sa(0.2)=	0.285	<	0.35	Acceptable for static analysis

This section is valid

Braced Frames	Ta=0.025hn	Ta=	0.2	Governs
Or (if more than one system)				
Steel Moment Frames	Ta=0.085(hn)^3/4	Ta=	0.40433	
		Therefore		
		Ta=	0.2	

S(Ta)=	0.19
Rd=	3.00
Ro=	1.30
Mv=	1.00

V=	S(Ta)*Mv*Ie*W/(Rd*Ro)=	0.073	W

But Shall Not Be less than

V=	S(2.0)*Mv*Ie*W/(Rd*Ro)=	0.008	W

But Shall Not be Greater Than

V=	2/3*S(0.2)*Ie*W/(Rd*Ro)=	0.049	W

Use	5%	% of dead Weight

Designer: Lindsey Miller	Load Development Calculations	Job Number: 134231055
Checked by:		Date: 2/12/2013

Summary

Floor Loads

Dead Load=	3	kpa	62.655	psf
Live Load				
At grade	25	kpa	522.125	psf

Roof Loads

Dead Load=	4.3	kpa	2.09	psf			
Live Load=	1	kpa	20.89	psf			
Basic Snow Load=	3.15	kPa	65.772	psf			
Snow Drift Load=	0.75	kpa	15.66	psf	Xd=	-3.2	m

Wind Loads

Winward=	1.516416	kPa	31.67036	psf
Leeward=	-1.37535	kPa	-28.7243	psf
Uplift=	-2.0454	kPa	-42.7182	psf

Seismic Load

5%	% of dead Weight

Designer: Lindsey Miller	Load Development Calculations	Job Number: 134231055
Checked by:		Date: 2/12/2013

Factored Load Combinations

Roof loading

ULS Loads

D=	3.1	**kPa**		**W_r =**	-2.05	**kPa**
D_{min}=	4.30	**kPa**	**Used for uplift calc.**	**W_w =**	1.52	**kPa**
S =	3.90	**kPa**		**W_l =**	-1.38	**kPa**
				L =	1.00	**kPa** **Minimum Roof LL**
				E =	0.22	kN

Case	**(ULS) Load Combination**						**Case**					**Total**			
	Principle							**Companion**				**Vertical**		**Horizontal**	
1	1.4	**D**			0.00	**kN/m**	**1**					0.00	**kN/m**		
2(a)	1.25	**D +**	1.5	**L =**	5.38	**kPa**	**2(a)**	0.5	**S =**	1.95	**kPa**	7.33	**kPa**		
2(b)	1.25	**D +**	1.5	**L =**	5.38	**kPa**	**2(b)**	0.4	**W_r =**	-0.82	**kPa**	4.56	**kPa**	0.61	**D=**
								0.4	**W_w =**	0.607	**D=**				
2(c)	0.9	**D_H +**	1.5	**L =**	5.37	**kPa**	**2(c)**	0.5	**S =**	1.95	**kPa**	7.32	**kPa**		
2(d)	0.9	**D_H +**	1.5	**L =**	5.37	**kPa**	**2(d)**	0.4	**W_r =**	-0.82	**kPa**	4.55	**kPa**	0.61	**D=**
								0.4	**W_w =**	0.607	**D=**				
3(a)	1.25	**D +**	1.5	**S =**	9.73	**kPa**	**3(a)**	0.5	**L =**	0.5	**kPa**	10.23	**kPa**		
3(b)	1.25	**D +**	1.5	**S =**	9.73	**kPa**	**3(b)**	0.4	**W_r =**	-0.82	**kPa**	8.91	**kPa**	0.61	**D=**
								0.4	**W_w =**	0.607	**D=**				
3(c)	0.9	**D_{min} +**	1.5	**S =**	9.72	**kPa**	**3(c)**	0.5	**L =**	0.5	**kPa**	10.22	**kPa**		
3(d)	0.9	**D_{min} +**	1.5	**S =**	9.72	**kPa**	**3(d)**	0.4	**W_r =**	-0.82	**kPa**	8.90	**kPa**	0.61	**D=**
								0.4	**W_w =**	0.607	**D=**				
4(a)	1.25	**D +**	1.4	**W_r =**	1.01	**kPa**	**4(a)**	0.5	**L =**	0.5	**kPa**	1.51	**kPa**	6.00	**D=**
			1.4	**W_w =**	6.00	**kPa**									
4(b)	1.25	**D +**	1.4	**W_r =**	1.01	**kPa**	**4(b)**	0.5	**S =**	1.95	**kPa**	2.96	**kPa**	6.00	**D=**
			1.4	**W_w =**	6.00	**kPa**									
4(c)	0.9	**D_{min} +**	1.4	**W_r =**	-0.07	**kPa**	**4(c)**	0.5	**L =**	0.5	**kPa**	0.43	**kPa**	4.91	**D=**
			1.4	**W_w =**	4.91	**kPa**									
4(d)	0.9	**D_{min} +**	1.4	**W_r =**	-0.07	**kPa**	**4(d)**	0.5	**S =**	1.95	**kPa**	1.88	**kPa**	4.91	**D=**
			1.4	**W_w =**	4.91	**kPa**									
5	1	**D +**	1	**E =**	3.32	**kPa**	**5**	0.25	**S =**	0.975	**kPa**	4.79	**kPa**		
								0.5	**L =**	0.5	**kPa**	3.82	**kPa**		

Max =	10.23	**kPa**
Min =	0.43	**kPa**

WS Loads

D=	4.30	**kN/m**	**W =**	1.52	**kN/m**
S =	3.90	**kN/m**	**L =**	1.00	**kN**

Case	**Working Stress Design (WS)**				
	Vertical				
1	1.00	**D +**	1.00	**S =**	8.20 **kN/m**

Designer: Lindsey Miller	Load Development Calculations	Job Number: 134231055
Checked by:		Date: 2/12/2013

Factored Load Combinations

Roof loading

ULS Loads

			W_r =	-2.05	kPa
D=	3.1	kPa	W_w =	1.52	kPa
D_{min}=	4.30	kPa Used for uplift calc.	W_l =	-1.38	kPa
S =	3.90	kPa	L =	1.00	kPa Minimum Roof LL
			E =	0.22	kN

Case	(ULS) Load Combination Principle						Case	Companion				Total Vertical		Horizontal	
1		D			0.00	kN/m	1					0.00	kN/m		
2(a)	1	D +	1	L =	4.10	kPa	2(a)	1	S =	3.9	kPa	8.00	kPa		
2(b)	1	D +	1	L =	4.10	kPa	2(b)	1	W_r =	-2.05	kPa	2.05	kPa	0.00	D=
									W_w =	0	D=				
2(c)	1	D_H +	1	L =	5.30	kPa	2(c)	1	S =	3.9	kPa	9.20	kPa		
2(d)	1	D_H +	1	L =	5.30	kPa	2(d)	1	W_r =	-2.05	kPa	3.25	kPa	1.52	D=
								1	W_w =	1.516	D=				
3(a)	1	D +	1	S =	7.00	kPa	3(a)	1	L =	1	kPa	8.00	kPa		
3(b)	1	D +	1	S =	7.00	kPa	3(b)	1	W_r =	-2.05	kPa	4.95	kPa	1.52	D=
								1	W_w =	1.516	D=				
3(c)	1	D_{min} +	1	S =	8.20	kPa	3(c)	1	L =	1	kPa	9.20	kPa		
3(d)	1	D_{min} +	1	S =	8.20	kPa	3(d)	1	W_r =	-2.05	kPa	6.15	kPa	1.52	D=
								1	W_w =	1.516	D=				
4(a)	1	D +	1	W_r =	1.05	kPa	4(a)	1	L =	1	kPa	2.05	kPa	4.62	D=
			1	W_w =	4.62	kPa									
4(b)	1	D +	1	W_r =	1.05	kPa	4(b)	1	S =	3.9	kPa	4.95	kPa	4.62	D=
			1	W_w =	4.62	kPa									
4(c)	1	D_{min} +	1	W_r =	1.05	kPa	4(c)	1	L =	1	kPa	2.05	kPa	4.62	D=
			1	W_w =	4.62	kPa									
4(d)	1	D_{min} +	1	W_r =	1.05	kPa	4(d)	1	S =	3.9	kPa	4.95	kPa	4.62	D=
			1	W_w =	4.62	kPa									
5	1	D +	1	E =	3.32	kPa	5	1	S =	3.9	kPa	8.22	kPa		
								1	L =	1	kPa	4.32	kPa		

Max =	9.20	kPa
Min =	2.05	kPa

Designer: Lindsey Miller		Tributary Areas and Loading					2/12/2013
Checked By:							

Factors

f'c=	30	MPa	30	N/mm^2	design criteria	
qsr=	150	kPa	150		design criteria	
factored loading		10.23	KPa	0.010225	N/mm^2	
unfactored		9.20	KPa	0.0092	N/mm^2	
Winward		1.516416	KPa			
Leeward		-1.37535	KPa			

Area	Width	Wind Bearir	Length	Height	TA	Panel	P	Pf	M
	m		m	m	m^2	m^2	kN	kN	kN*m
1	4.5	<	10	8	45	36	414	460.125	34.70125
2	4.5	<	5	8	22.5	36	207	230.0625	34.70125
3	2	>	2.5	8	5	20	46	51.125	30.328329
4	2	>	5	8	10	40	92	102.25	60.656657
5	2	<	1.5	8	3	16	27.6	30.675	24.262663
6	2	>	3.5	8	7	28	64.4	71.575	42.45966
7	2	>	3	8	6	24	55.2	61.35	36.393994

Select largest and 2nd largest Pf, lrgst M & smallest Pf&M

1	Lrgst Pf
2	2nd Lrgst Pf
4	Lrgst M
5	Smallest

Factors							
FLC = Pf	10.225	KPa	0.010	N/mm^2	α1=	0.850	
ULC	9.200	KPa	0.009	N/mm^2	β1	1.000	
TW	4.500	m	4500.000	mm			
Span	10.000	m	10000.000	mm	φs	0.900	
		E=	200000.000	N/mm^2	φc	0.650	
Beam 1B-3B							
Tributary Width						4.500	m
Factored Loading		Wf=TW*Pf=				46.013	KN/m
Unfactored Loading		P=TA*loading=				41.400	KN/m
Factored Loading * TA						460.125	KN
Mu=	(Wu*L^2)/8					575.156	kN*m
Vf=	(Wu*L)/2					230.063	KN
Ireq'd =	Wu*Cd*Bd					1.06E+09	mm^4
Cd from Fig 5.1		2.30E+06					
Bd from table 5.5		1.000					
Select Shape							
Use tables from chapter five to select steel that is greater than the required Mu, Vf & Ireq							
W690x125							
Mr	1250.000	>	575.156	checks			
Vr	1610.000	>	230.063	checks			
Ix	1.19E+09	>	1.06E+09	checks			
	Plug and Compare						
Deflection							
from load development excel sheet							
Service Load = LL + SL=						4.9	kPa
Dead Load = DL + beam self weight =						4.33	kPa
Wdl	load*trib L					19.485	kN/m
Wsl	load*trib L					22.050	kN/m
Δdl	(5(w)*L^4)/(384*E*Ix)					10.660	mm
Δsl	(5(w)*L^4)/(384*E*Ix)					12.063	mm
Δdl	10.660	≤	span/240	41.667	mm	checks	
Δsl	12.063		span/360	27.778	mm	checks	
	Plug and Compare						
Shape							
W690x125 checks							

Factors							
FLC = Pf	10.225	KPa	0.010	N/mm^2	α1=	0.850	
ULC	9.200	KPa	0.009	N/mm^2	β1	1.000	
TW	2.000	m	2000.000	mm			
Span	5.000	m	5000.000	mm	ϕs	0.900	
		E=	200000.000	N/mm^2	ϕc	0.650	
A1-A2							
Tributary Width						2.000	m
Factored Loading		Wf=TW*Pf=				20.450	KN/m
Unfactored Loading		P=TA*loading=				18.400	KN/m
Factored Loading * TA						102.250	KN
Mu=	(Wu*L^2)/8					63.906	kN*m
Vf=	(Wu*L)/2					51.125	KN
Ireq'd =	Wu*Cd*Bd					5.11E+07	mm^4
Cd from Fig 5.1		5.00E+05					
Bd from table 5.5		1.000					
Select Shape							
Use tables from chapter five to select steel that is greater than the required Mu, Vf & Ireq							
W310x28							
Mr	126.000	>	63.906	checks			
Vr	380.000	>	51.125	checks			
Ix	5.43E+07	>	5.11E+07	checks			
	Plug and Compare						
Deflection							
from load development excel sheet							
Service Load = LL + SL=						4.9	kPa
Dead Load = DL + beam self weight =						3.378	kPa
Wdl	load*trib L					6.756	kN/m
Wsl	load*trib L					9.800	kN/m
Δdl	(5(w)*L^4)/(384*E*Ix)					5.063	mm
Δsl	(5(w)*L^4)/(384*E*Ix)					7.344	mm
Δdl	5.063	≤	span/240	20.833	mm	checks	
Δsl	7.344		span/360	13.889	mm	checks	
	Plug and Compare						
Shape							
W310x28	checks						

Factors

FLC = Pf	10.225	KPa	0.010	N/mm^2	α1=	0.850	
ULC	9.200	KPa	0.009	N/mm^2	β1	1.000	
TW	2.000	m	2000.000	mm			
Span	3.000	m	3000.000	mm	ϕs	0.900	
		E=	200000.000	N/mm^2	ϕc	0.650	

Beam 1D-1.5D

Tributary Width						2.000	m
Factored Loading		Wf=TW*Pf=				20.450	KN/m
Unfactored Loading		P=TA*loading=				18.400	KN/m
Factored Loading * TA						61.350	KN
Mu=	(Wu*L^2)/8					23.006	kN*m
Vf=	(Wu*L)/2					30.675	KN
Ireq'd =	Wu*Cd*Bd					1.23E+07	mm^4
Cd from Fig 5.1		2.00E+05					
Bd from table 5.5		1.000					

Select Shape

Use tables from chapter five to select steel that is greater than the required Mu, Vf & Ireq

W310x28					
Mr	126.000	>	23.006	checks	
Vr	380.000	>	30.675	checks	
Ix	5.43E+07	>	1.23E+07	checks	
	Plug and Compare				

Deflection

from load development excel sheet							
Service Load = LL + SL=						4.9	kPa
Dead Load = DL + beam self weight =						3.378	kPa
Wdl	load*trib L					6.756	kN/m
Wsl	load*trib L					9.800	kN/m
Δdl	(5(w)*L^4)/(384*E*Ix)					0.656	mm
Δsl	(5(w)*L^4)/(384*E*Ix)					0.952	mm
Δdl	0.656	≤	span/240	12.500	mm	checks	
Δsl	0.952		span/360	8.333	mm	checks	
	Plug and Compare						
Shape							
W310x28	checks						

Factors							
FLC = Pf	10.225	KPa	0.010	N/mm^2	α1=	0.850	
ULC	9.200	KPa	0.009	N/mm^2	β1	1.000	
TW	2.000	m	2000.000	mm			
Span	4.000	m	4000.000	mm	ϕs	0.900	
		E=	200000.000	N/mm^2	ϕc	0.650	
Beam 1.5D-2.5D							
Tributary Width						2.000	m
Factored Loading		Wf=TW*Pf=				20.450	KN/m
Unfactored Loading		P=TA*loading=				18.400	KN/m
Factored Loading		* TA				81.800	KN
Mu=	(Wu*L^2)/8					40.900	kN*m
Vf=	(Wu*L)/2					40.900	KN
Ireq'd =	Wu*Cd*Bd					1.64E+07	mm^4
Cd from Fig 5.1		2.00E+05					
Bd from table 5.5		1.000					
Select Shape							
Use tables from chapter five to select steel that is greater than the required Mu, Vf & Ireq							
W310x28							
Mr	126.000	>	40.900	checks			
Vr	380.000	>	40.900	checks			
Ix	5.43E+07	>	1.64E+07	checks			
	Plug and Compare						
Deflection							
from load development excel sheet							
Service Load = LL + SL=						4.9	kPa
Dead Load = DL + beam self weight =						3.378	kPa
Wdl	load*trib L					6.756	kN/m
Wsl	load*trib L					9.800	kN/m
Δdl	(5(w)*L^4)/(384*E*Ix)					2.074	mm
Δsl	(5(w)*L^4)/(384*E*Ix)					3.008	mm
Δdl	2.074	≤	span/240	16.667	mm	checks	
Δsl	3.008		span/360	11.111	mm	checks	
	Plug and Compare						
Shape							
W310x28	checks						

Factors							
FLC = Pf	10.225	KPa	0.010	N/mm^2	α1=	0.850	
ULC	9.200	KPa	0.009	N/mm^2	β1	1.000	
TW	10.000	m	10000.000	mm			
Span	5.000	m	5000.000	mm	ϕs	0.900	
		E=	200000.000	N/mm^2	ϕc	0.650	
Beam 3B-3C							
Tributary Width						10.000	m
Factored Loading		Wf=TW*Pf=				102.250	KN/m
Unfactored Loading		P=TA*loading=				92.000	KN/m
Factored Loading * TA						511.250	KN
Mu=	(Wu*L^2)/8					319.531	kN*m
Vf=	(Wu*L)/2					255.625	KN
Ireq'd =	Wu*Cd*Bd					2.56E+08	mm^4
Cd from Fig 5.1		5.00E+05					
Bd from table 5.5		1.000					
Select Shape							
Use tables from chapter five to select steel that is greater than the required Mu, Vf & Ireq							
W530x66							
Mr	484.000	>	319.531	checks			
Vr	928.000	>	255.625	checks			
Ix	3.51E+08	>	2.56E+08	checks			
	Plug and Compare						
Deflection							
from load development excel sheet							
Service Load = LL + SL=						4.9	kPa
Dead Load = DL + beam self weight =						3.745	kPa
Wdl	load*trib L					37.450	kN/m
Wsl	load*trib L					49.000	kN/m
Δdl	(5(w)*L^4)/(384*E*Ix)					4.341	mm
Δsl	(5(w)*L^4)/(384*E*Ix)					5.680	mm
Δdl	4.341	≤	span/240	20.833	mm	checks	
Δsl	5.680		span/360	13.889	mm	checks	
	Plug and Compare						
Shape							
W530x66	checks						

Factors							
FLC = Pf	10.225	KPa	0.010	N/mm^2	α_1=	0.850	
ULC	9.200	KPa	0.009	N/mm^2	β_1	1.000	
TW	10.000	m	10000.000	mm			
Span	4.000	m	4000.000	mm	ϕ_s	0.900	
		E=	200000.000	N/mm^2	ϕ_c	0.650	
Beam 3A-3B							
Tributary Width						10.000	m
Factored Loading		Wf=TW*Pf=				102.250	KN/m
Unfactored Loading		P=TA*loading=				92.000	KN/m
Factored Loading * TA						409.000	KN
Mu=	(Wu*L^2)/8					204.500	kN*m
Vf=	(Wu*L)/2					204.500	KN
Ireq'd =	Wu*Cd*Bd					1.64E+08	mm^4
Cd from Fig 5.1		4.00E+05					
Bd from table 5.5		1.000					
Select Shape							
Use tables from chapter five to select steel that is greater than the required Mu, Vf & Ireq							
W460x52							
Mr	338.000	>	204.500	checks			
Vr	680.000	>	204.500	checks			
Ix	2.12E+08	>	1.64E+08	checks			
	Plug and Compare						
Deflection							
from load development excel sheet							
Service Load = LL + SL=						4.9	kPa
Dead Load = DL + beam self weight =						3.61	kPa
Wdl	load*trib L					36.100	kN/m
Wsl	load*trib L					49.000	kN/m
Δdl	(5(w)*L^4)/(384*E*Ix)					2.838	mm
Δsl	(5(w)*L^4)/(384*E*Ix)					3.852	mm
Δdl	2.838	$\leq$	span/240	16.667	mm	checks	
Δsl	3.852		span/360	11.111	mm	checks	
	Plug and Compare						
Shape							
W460x52	checks						

Factors							
FLC = Pf	10.225	KPa	0.010	N/mm^2	α1=	0.850	
ULC	9.200	KPa	0.009	N/mm^2	β1	1.000	
TW	5.000	m	5000.000	mm			
Span	5.000	m	5000.000	mm	ϕs	0.900	
		E=	200000.000	N/mm^2	ϕc	0.650	
Beam 1B-1C							
Tributary Width						5.000	m
Factored Loading		Wf=TW*Pf=				51.125	KN/m
Unfactored Loading		P=TA*loading=				46.000	KN/m
Factored Loading * TA						255.625	KN
Mu=	(Wu*L^2)/8					159.766	kN*m
Vf=	(Wu*L)/2					127.813	KN
Ireq'd =	Wu*Cd*Bd					1.28E+08	mm^4
Cd from Fig 5.1		5.00E+05					
Bd from table 5.5		1.000					
Select Shape							
Use tables from chapter five to select steel that is greater than the required Mu, Vf & Ireq							
W410x46							
Mr	275.000	>	159.766	checks			
Vr	578.000	>	127.813	checks			
Ix	1.56E+08	>	1.28E+08	checks			
	Plug and Compare						
Deflection							
from load development excel sheet							
Service Load = LL + SL=						4.9	kPa
Dead Load = DL + beam self weight =						3.554	kPa
Wdl	load*trib L					17.770	kN/m
Wsl	load*trib L					24.500	kN/m
Δdl	(5(w)*L^4)/(384*E*Ix)					4.635	mm
Δsl	(5(w)*L^4)/(384*E*Ix)					6.390	mm
Δdl	4.635	≤	span/240	20.833	mm	checks	
Δsl	6.390		span/360	13.889	mm	checks	
	Plug and Compare						
Shape							
W410x46	checks						

Factors							
FLC = Pf	10.225	KPa	0.010	N/mm^2	α1=	0.850	
ULC	9.200	KPa	0.009	N/mm^2	β1	1.000	
TW	5.000	m	5000.000	mm			
Span	4.000	m	4000.000	mm	ϕs	0.900	
		E=	200000.000	N/mm^2	ϕc	0.650	
Beam 1A-1B							
Tributary Width						5.000	m
Factored Loading	Wf=TW*Pf=					51.125	KN/m
Unfactored Loading	P=TA*loading=					46.000	KN/m
Factored Loading * TA						204.500	KN
Mu=	(Wu*L^2)/8					102.250	kN*m
Vf=	(Wu*L)/2					102.250	KN
Ireq'd =	Wu*Cd*Bd					8.18E+07	mm^4
Cd from Fig 5.1		4.00E+05					
Bd from table 5.5		1.000					
Select Shape							
Use tables from chapter five to select steel that is greater than the required Mu, Vf & Ireq							
W360x33							
Mr	168.000	>	102.250	checks			
Vr	396.000	>	102.250	checks			
Ix	8.27E+07	>	8.18E+07	checks			
	Plug and Compare						
Deflection							
from load development excel sheet							
Service Load = LL + SL=						4.9	kPa
Dead Load = DL + beam self weight =						3.484	kPa
Wdl	load*trib L					17.420	kN/m
Wsl	load*trib L					24.500	kN/m
Δdl	(5(w)*L^4)/(384*E*Ix)					3.511	mm
Δsl	(5(w)*L^4)/(384*E*Ix)					4.938	mm
Δdl	3.511	≤	span/240	16.667	mm	checks	
Δsl	4.938		span/360	11.111	mm	checks	
	Plug and Compare						
Shape							
W360x33	checks						

Designer: Lindsey Miller	Load Development Calculations	Job Number: 134231055
Checked by:		2/13/2013

Summary

Floor Loads							
Dead Load=		3	kpa	62.655	psf		
Live Load							
	At grade	25	kpa	522.125	psf		
Roof Loads							
Dead Load=	4.3	kpa	2.09	psf		3.1	D (no uplift)
Live Load=	1	kpa	20.89	psf			
Basic Snow Load=	3.15	kPa	65.772	psf			
Snow Drift Load=	0.75	kpa	15.66	psf			
Snow Total=	3.9			Xd=		-3.2	m

Wind Loads				
Winward=	1.516416	kPa	31.67	psf
Leeward=	-1.37535	kPa	-28.72	psf
Uplift=	-2.0454	kPa	-42.72	psf

Seismic Load

5% % of dead Weight

Load Combinations

FLC		
Max =	10.23	**kPa**
Min =	0.43	**kPa**
ULC		
Max =	9.20	**kPa**
Min =	2.05	**kPa**

Column					
Location	Size	Type	Location	Size	Type
1A	W8400x193	4	3C	W1100x499	1.0
1B	W1000x321	2	3D	W8400x193	4.0
1C	W1000x321	2	3.5D	W8400x193	4.0
1D	W610x113	5	4A	W8400x193	4.0
1.5D	W8400x193	4	4.5D	W8400x193	4.0
2A	W8400x193	4	5A	W8400x193	4.0
2.5D	W8400x193	4	5B	W1000x321	2.0
3A	W8400x193	4	5C	W1000x321	2.0
3B	W1100x499	1	5D	W610x113	5.0

Designer: Lindsey Miller | Factors

Checked By:

factored loading	10.23	KPa	0.010225	N/mm^2
unfactored	9.20	KPa	0.0092	N/mm^2
Winward	1.52	KPa		
Leeward	-1.38	KPa		

Area	Width	Wind Bearir	Length	Height	TA	Panel
	m		m	m	m^2	m^2
1	4.5	<	10	8	45	36
2	4.5	<	5	8	22.5	36
3	2	>	2.5	8	5	20
4	2	>	5	8	10	40
5	2	<	1.5	8	3	16
6	2	>	3.5	8	7	28
7	2	>	3	8	6	24

Select largest and 2nd largest Pf, lrgst M & smallest Pf&M

1	Lrgst Pf
2	2nd Lrgst Pf
4	Lrgst M
5	Smallest

Area	P	Pf	M
	kN	kN	kN*m
1	414	460.125	34.70125045
2	207	230.0625	34.70125045
3	46	51.125	30.32832865
4	92	102.25	60.6566573
5	27.6	30.675	24.26266292
6	64.4	71.575	42.45966011
7	55.2	61.35	36.39399438

1- 3B									
Fy=	350	MPa	350	N/mm^2	assumed	factored loading		10.23	KPa
L =	8	m	8000	mm		unfactored		9.20	KPa
girt	1.2	m	1200	mm		Winward		1.52	KPa
b=	4	m	4000	mm		Leeward		-1.38	KPa
						Service Load =		4.90	
TA	45	m^2	4.50E+07	mm^2		P1 = SL*TA		220.5	kN
E=	200000	Mpa							
3B									
Tributary Area						45	m^2		
K=	pinned					1.000			
rx min						40.000	mm		
ry min						6.000	mm		
Max Deflection						16.000	mm		
Select Column		w	1100	x	499				
Use to find Fq									
		Fq= q*A				6.054	kN		
Is the Ix of wshape > Ix req?									
Ix req	PL^3/3*E*Δ + P(.5L^2) (3L-.5L)/6*E*Δ					1.19E+10	mm^4		
Does W-shape work?		p5-96							
Ix =	12900*10^	>	1.186E+10		no				
rx=	452	>	40		checks				
ry=	88.8	>	6		checks				
Factored Compressive Resistance									
Cr =	ΦAFy(1+λ^(2n))^(-1/n)								
KLx/rx =		table 4-4				17.699			
n =						1.340			
Φ =						0.900			
Fy =						350.000	Mpa		
A =						63400.000	mm^2		
table 4-4									
Cr/A =						310.000	Mpa		
Cr/A*A =						19654000.000	N	19654	kN
Fex =	(Pi^2*E)/(KL/r)					9.662	Mpa		
λ=	sqrt (Fy/Fe)					6.019			
Cr =						547968.207	N	547.968207	kN
				Mr=		227.000			
% utilizied	m/mr+p/cr					0.555		checks	
W-Shape	W1100x49	checks							

						2 - 1B				
Fy=	350	MPa	350	N/mm^2	assumed	factored loading		10.23	KPa	Fy=
L =	8	m	8000	mm		unfactored		9.20	KPa	L =
girt	1.2	m	1200	mm		Winward		1.52	KPa	girt
b=	4	m	4000	mm		Leeward		-1.38	KPa	b=
						Service Load =		4.90		
TA	22.5	m^2	2.25E+07	mm^2		P1 = SL*TA		110.25	kN	TA
E=	200000	Mpa								E=
						1B				
Tributary Area						22.5	m^2			Tribu
K=	pinned					1.000				K=
rx min						40.000	mm			rx mi
ry min						6.000	mm			ry mi
Max Deflection						16.000	mm			Max I
Select Column		w	1000	x	321					Selec
Use to find Fq										Use t
		Fq= q*A				3.894	kN			
Is the Ix of wshape > Ix req?										Is the
Ix req	PL^3/3*E*Δ + P(.5L^2) (3L-.5L)/6*E*Δ					5.94E+09	mm^4			Ix rec
Does W-shape work?		p5-96								Does
Ix =	6960*10^(	>	5.945E+09		no					Ix =
rx=	413	>	40		checks					rx=
ry=	90	>	6		checks					ry=
Factored Compressive Resistance										Facto
Cr =	ΦAFy(1+λ^(2n))^(-1/n)									Cr =
KLx/rx =		table 4-4				19.370				KLx/r
n =						1.340				n =
Φ =						0.900				Φ =
Fy =						350.000	Mpa			Fy =
A =						409000.000	mm^2			A =
table 4-4										table
Cr/A =						308.000	Mpa			Cr/A
Cr/A*A =						125972000.000	N	125972	kN	Cr/A*
Fex =	(Pi^2*E)/(KL/r)					11.573	Mpa			Fex =
λ=	sqrt (Fy/Fe)					5.499				λ=
Cr =						4227178.346	N	4227.178	kN	Cr =
				Mr=		4910.000				
% utilizied	m/mr+p/cr					0.033		checks		% util
W-Shape		W1000x321	checks							W-Sh

						4 - 2A				
Fy=	350	MPa	350	N/mm^2	assumed	factored loading		10.23	KPa	Fy=
L =	8	m	8000	mm		unfactored		9.20	KPa	L =
girt	1.2	m	1200	mm		Winward		1.52	KPa	girt
b=	4	m	4000	mm		Leeward		-1.38	KPa	b=
						Service Load =		4.90		
TA	10	m^2	1.00E+07	mm^2		P1 = SL*TA		49	kN	TA
E=	200000	Mpa								E=
						2A				
Tributary Area						10	m^2			Tribu
K=	pinned					1.000				K=
rx min						40.000	mm			rx mi
ry min						6.000	mm			ry mi
Max Deflection						16.000	mm			Max
Select Column		w	840	x	193					Selec
Use to find Fq										Use t
		Fq= q*A				2.341	kN			
Is the Ix of wshape > Ix req?										Is the
Ix req	PL^3/3*E*Δ + P(.5L^2) (3L-.5L)/6*E*Δ					2.65E+09	mm^4			Ix rec
Does W-shape work?		p5-96								Does
Ix =	27800*10	>	2.652E+09		no					Ix =
rx=	336	>	40		checks					rx=
ry=	60.5	>	6		checks					ry=
Factored Compressive Resistance										Factc
Cr =	ΦAFy(1+λ^(2n))^(-1/n)									Cr =
KLx/rx =		table 4-4				23.810				KLx/r
n =						1.340				n =
Φ =						0.900				Φ =
Fy =						350.000	Mpa			Fy =
A =						24700.000	mm^2			A =
table 4-4										table
Cr/A =						304.000	Mpa			Cr/A
Cr/A*A =						7508800.000	N	7508.8	kN	Cr/A*
Fex =	(Pi^2*E)/(KL/r)					17.484	Mpa			Fex =
λ=	sqrt (Fy/Fe)					4.474				λ=
Cr =						383528.619	N	383.5286194	kN	Cr =
				Mr=		2370.000				
% utilizied	m/mr+p/cr					0.128		checks		% uti
W-Shape		W8400x193	checks							W-Sh

				5- 1D					
Fy=	350	MPa	350	N/mm^2	assumed	factored loading		10.23	KPa
L =	8	m	8000	mm		unfactored		9.20	KPa
girt	1.2	m	1200	mm		Winward		1.52	KPa
b=	4	m	4000	mm		Leeward		-1.38	KPa
						Service Load =		4.90	
TA	3	m^2	3.00E+06	mm^2		P1 = SL*TA		14.7	kN
E=	200000	Mpa							
				1D					
Tributary Area						3	m^2		
K=	pinned					1.000			
rx min						40.000	mm		
ry min						6.000	mm		
Max Deflection						16.000	mm		
Select Column		w	610	x	113				
Use to find Fq									
		Fq= q*A				1.371	kN		
Is the Ix of wshape > Ix req?									
Ix req	PL^3/3*E*Δ + P(.5L^2) (3L-.5L)/6*E*Δ					8.07E+08	mm^4		
Does W-shape work?		p5-96							
Ix =	807*10^6	>	8.068E+08		no				
rx=	246	>	40		checks				
ry=	48.7	>	6		checks				
Factored Compressive Resistance									
Cr =	ΦAFy(1+λ^(2n))^(-1/n)								
KLx/rx =		table 4-4				32.520			
n =						1.340			
Φ =						0.900			
Fy =						350.000	Mpa		
A =						14400.000	mm^2		
table 4-4									
Cr/A =						291.000	Mpa		
Cr/A*A =						4190400.000	N	4190.4	kN
Fex =	(Pi^2*E)/(KL/r)					32.618	Mpa		
λ=	sqrt (Fy/Fe)					3.276			
Cr =						410070.086	N	410.0700858	kN
				Mr=		1020.000			
% utilizied	m/mr+p/cr					0.036		checks	
W-Shape		W610x113 checks							

Designer: Lindsey Miller				Foundation Design					1/21/2013	
Checked By:										
				Factors						
				Footing 1 -REDESIGN						
		f'c=	30	MPa	30	N/mm^2	design criteria			
		Fy=	400	MPa	400	N/mm^2	assumed			
		hc=	0.5	m	500	mm	assumed			
		qsr=	150	kPa	150		design criteria			
		factored lc	9.013	KPa	0.009013	N/mm^2				
		unfactored	7.354	KPa	0.007354	N/mm^2				
		Tributary A	22.5	m^2	2.25E+07	mm^2				
		ϕc	0.65	ϕs	0.85					
				Footing 1						
Tributary Area							22.5	m^2		
Factored Loading		Pf=TA*loading=					202.7925	KN	202792.5	N
Unfactored Loading		P=TA*loading=					165.465	KN		
Pf>Fbr = 0.85*ϕc*f'c*Ac			meaning	Pf/(0.85*ϕc*f'c) = Ac			12234.84	mm^2		
hc= SQRT(Ac)							110.6112	mm		
USE							500	mm		
Bearing Capacity										
qapp = P/Af <=qallow		Af=					1.1031	m^2		
b = sqrt (Af)							1.050286	m		
Design for 85%										
qsr*.85 =							127.5	Kpa		
New Af							1.297765	m^2	1297764.706	mm^2
New b							1.139195	m	1139.194762	mm
USE							1.2	m	1200	mm
qapp=	114.9063	<	150	checked						
Final A =							1.44	m^2		
ab = (b-hc)*1/2							0.35	m	350	mm
Shear Capacity										
qf=Pf/Af=							140.8281	KN/m^2		
One Way							0.140828	N/mm^2		
Vf = qf*b*(ab-d)			Vc = 0.2*ϕc*sprt(F'c)*b*d							
solve for d										
Vf=	qf*b*ab -	qf*b*d								
Vc=	0.2*0.65*sqrt(f'c)*b*d									
	qf*b*ab=	(0.2*0.65*sqrt(f'c)*b + qf*b)d								
	d=	(qf*ab)/(0.2*0.65*sqrt(f'c) + qf)					57.79309	mm		
USE d=							75	mm		
							0.075	m		
Check										
Vf							59.14781	KN	59147.8125	N
Vc							64.08354	KN	64083.53923	N

Vf < Vc							Checks			
Table 9.11										
ab =							350	mm		
Bar Size =							20	M	19.5	mm
A bar							300	mm^2		
Thickness										
d+depth to bury bar+barsize/2										
depth =	75	mm					160	mm		
Round Up to next 100							200	mm		
Two Way Shear										
Vf =	qf*(b^2 - (hc-2d/2)^2)						177.3554	KN		
bod=	4(hc+2d/2)*d						0.1725	m^2	172500	mm^2
bo=							2.3	m	2300	mm
Vf/bod =							1028.147	KN/m^2		
							1.028147	Mpa		
vr =>	0.4*ϕc*SQRT(f'c)						1.424079			
	(1+(2/Bc))*.2*ϕc*SQRT(f'c)						2.136118			
	((αs*d/bo)+0.2)*ϕc*SQRT(f'c)						1.176413	1.176413		MPA
Vf =	1.028147	vr =	1.176413							
	Vf	<	vr				CHECKS			
Steel Select										
Mf=	qf*(b/2)*((b-c)/2)=						29.57391	KN*m		
Kr=	(Mf*10^6)/(b*d^2)						4.381319			
Table 2.1 Interpolation										
ρ=	1.55	%					0.0155			
As = ρ*b*d							0.001395	m^2		
							1395	mm^2		
As min=	0.002*Ag=	0.002*b*t					0.00048	m^2		
							480	mm^2		
Governing							1395			
# bars										
As/ab=							4.65			
USE							5.0	bars		
Spacing										
s=(b-2*75-bars*SizeM)/(#bars-1)							238.125	mm		
3 checks for spacing										
S > or =	1.4*dia of M						27.3			
	1.4*M						28			
	30mm						30			
Max =							238.125	mm		

Designer: Lindsey Miller				Foundation Design					1/24/2013
Checked By:									
					Factors				
					Footing 1				
		f'c=	30	MPa	30	N/mm^2	design criteria		
		Fy=	400	MPa	400	N/mm^2	assumed		
		hc=	0.5	m	500	mm	assumed		
		qsr=	150	kPa	150		design criteria		
		factored loading	10.23	KPa	0.009013	N/mm^2			
		unfactored	9.20	KPa	0.007354	N/mm^2			
		Tributary Area	45	m^2	4.50E+07	mm^2			
		φc	0.65	φs	0.85				
					Footing 1				
Tributary Area						45	m^2		
Factored Loading		Pf=TA*loading=				460.125	KN	460125	N
Unfactored Loading		P=TA*loading=				414	KN		
Pf>Fbr = 0.85*φc*f'c*Ac			meaning	Pf/(0.85*φc*f'c) = Ac		27760.18	mm^2		
hc= SQRT(Ac)						166.6139	mm		
USE						500	mm		
Bearing Capacity									
qapp = P/Af <=qallow		Af=				2.76	m^2		
b = sqrt (Af)						1.661325	m		
Design for 85%									
qsr*.85 =						127.5	Kpa		
New Af						3.247059	m^2	3247059	mm^2
New b						1.80196	m	1801.96	mm
USE						1.7	m	1700	mm
qapp=	143.2526	<	150	checked					
Final A =						2.89	m^2		
ab = (b-hc)*1/2						0.6	m	600	mm
Shear Capacity									
qf=Pf/Af=						159.2128	KN/m^2		
One Way						0.159213	N/mm^2		
Vf = qf*b*(ab-d)		Vc = 0.2*φc*sprt(F'c)*b*d							
solve for d									
Vf=	qf*b*ab -	qf*b*d							
Vc=	0.2*0.65*sqrt(f'c)*b*d								
	qf*b*ab=	(0.2*0.65*sqrt(f'c)*b + qf*b)d							
	d=	(qf*ab)/(0.2*0.65*sqrt(f'c) + qf)				109.6441	mm		
USE d=						150	mm		
						0.15	m		
Check									
Vf						162.3971	KN	162397.1	N
Vc						181.57	KN	181570	N

Vf < Vc						Checks			
Table 9.11									
ab =						600	mm		
Bar Size =					8	15	M	16	mm
A bar						200	mm^2		
Thickness									
d+depth to bury bar+barsize/2									
depth =	75	mm				232.5	mm		
Round Up to next 100						300	mm		
Two Way Shear									
Vf =	qf*(b^2 - (hc-2d/2)^2)					440.6214	KN		
bod=	4(hc+2d/2)*d					0.39	m^2	390000	mm^2
bo=						2.6	m	2600	mm
Vf/bod =						1129.799	KN/m^2		
						1.129799	Mpa		
vr =>	0.4*ϕc*SQRT(f'c)					1.424079			
	(1+(2/Bc))*.2*ϕc*SQRT(f'c)					2.136118			
	((αs*d/bo)+0.2)*ϕc*SQRT(f'c)					1.533623	1.424079		MPA
Vf =	1.129799	vr =	1.424079						
	Vf	<	vr			CHECKS			
Steel Select									
Mf=	qf*(b/2)*((b-c)/2)=					81.19853	KN*m		
Kr=	(Mf*10^6)/(b*d^2)					2.122837			
Table 2.1 Interpolation									
ρ=	0.6	%				0.006			
As = ρ*b*d						0.00153	m^2		
						1530	mm^2		
As min=	0.002*Ag=	0.002*b*t				0.00102	m^2		
						1020	mm^2		
Governing						1530			
# bars									
As/ab=						7.65			
USE						8.0	bars		
Spacing									
s=(b-2*75-bars*SizeM)/(#bars-1)						199.1429	mm		
3 checks for spacing									
S > or =	14*dia of M					224			
	16*M					240			
	400mm					400			
Max =						199.1429	mm		

Designer: Lindsey Miller				Foundation Design					1/24/2013	
Checked By:										
				Factors						
				Footing 2						
		f'c=	30	MPa	30	N/mm^2	design criteria			
		Fy=	400	MPa	400	N/mm^2	assumed			
		hc=	0.5	m	500	mm	assumed			
		qsr=	150	kPa	150		design criteria			
		factored lc	10.23	KPa	0.009013	N/mm^2				
		unfactorec	9.20	KPa	0.007354	N/mm^2				
		Tributary A	22.5	m^2	2.25E+07	mm^2				
		φc	0.65	φs	0.85					
				Footing 2						
Tributary Area							22.5	m^2		
Factored Loading		Pf=TA*loading=					230.0625	KN	230062.5	N
Unfactored Loading		P=TA*loading=					207	KN		
Pf>Fbr = 0.85*φc*f'c*Ac			meaning	Pf/(0.85*φc*f'c) = Ac			13880.09	mm^2		
hc= SQRT(Ac)							117.8138	mm		
USE							500	mm		
Bearing Capacity										
qapp = P/Af <=qallow		Af=					1.38	m^2		
b = sqrt (Af)							1.174734	m		
Design for 85%										
qsr*.85 =							127.5	Kpa		
New Af							1.623529	m^2	1623529.412	mm^2
New b							1.274178	m	1274.177936	mm
USE							1.2	m	1200	mm
qapp=	143.75	<	150	checked						
Final A =							1.44	m^2		
ab = (b-hc)*1/2							0.35	m	350	mm
Shear Capacity										
qf=Pf/Af=							159.7656	KN/m^2		
One Way							0.159766	N/mm^2		
Vf = qf*b*(ab-d)			Vc = 0.2*φc*sprt(F'c)*b*d							
solve for d										
Vf=	qf*b*ab -	qf*b*d								
Vc=	0.2*0.65*sqrt(f'c)*b*d									
	qf*b*ab=	(0.2*0.65*sqrt(f'c)*b + qf*b)d								
	d=	(qf*ab)/(0.2*0.65*sqrt(f'c) + qf)					64.14046	mm		
USE d=							75	mm		
							0.075	m		
Check										
Vf							67.10156	KN	67101.5625	N
Vc							64.08354	KN	64083.53923	N

Vf < Vc				Checks			
Table 9.11							
ab =				350	mm		
Bar Size =				20	M	19.5	mm
A bar				300	mm^2		
Thickness							
d+depth to bury bar+barsize/2							
depth =	75	mm		160	mm		
Round Up to next 100				200	mm		
Two Way Shear							
Vf =	qf*(b^2 - (hc-2d/2)^2)			201.2048	KN		
bod=	4(hc+2d/2)*d			0.1725	m^2	172500	mm^2
bo=				2.3	m	2300	mm
Vf/bod =				1166.405	KN/m^2		
				1.166405	Mpa		
vr =>	0.4*ϕc*SQRT(f'c)			1.424079			
	(1+(2/Bc))*.2*ϕc*SQRT(f'c)			2.136118			
	((αs*d/bo)+0.2)*ϕc*SQRT(f'c)			1.176413	1.176413		MPA
Vf =	1.166405	vr =	1.176413				
	Vf	<	vr	CHECKS			
Steel Select							
Mf=	qf*(b/2)*((b-c)/2)=			33.55078	KN*m		
Kr=	(Mf*10^6)/(b*d^2)			4.970486			
Table 2.1 Interpolation							
ρ=	1.79	%		0.0179			
As = ρ*b*d				0.001611	m^2		
				1611	mm^2		
As min=	0.002*Ag=	0.002*b*t		0.00048	m^2		
				480	mm^2		
Governing				1611			
# bars							
As/ab=				5.37			
USE				6.0	bars		
Spacing							
s=(b-2*75-bars*SizeM)/(#bars-1)				186.6	mm		
3 checks for spacing							
S > or =	14*dia of M			273			
	16*M			320			
	400			400			
Max =				186.6	mm		

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Checked By:										
				Factors						
				Footing 4						
		f'c=	30	MPa	30	N/mm^2	design criteria			
		Fy=	400	MPa	400	N/mm^2	assumed			
		hc=	0.5	m	500	mm	assumed			
		qsr=	150	kPa	150		design criteria			
		factored lc	10.23	KPa	0.009013	N/mm^2				
		unfactorec	9.20	KPa	0.007354	N/mm^2				
		Tributary A	10	m^2	1.00E+07	mm^2				
		ϕc	0.65	ϕs	0.85					
				Footing 4						
Tributary Area							10	m^2		
Factored Loading		Pf=TA*loading=					102.25	KN	102250	N
Unfactored Loading		P=TA*loading=					92	KN		
Pf>Fbr = 0.85*ϕc*f'c*Ac			meaning	Pf/(0.85*ϕc*f'c) = Ac			6168.929	mm^2		
hc= SQRT(Ac)							78.54253	mm		
USE							500	mm		
Bearing Capacity										
qapp = P/Af <=qallow		Af=					0.613333	m^2		
b = sqrt (Af)							0.783156	m		
Design for 85%										
qsr*.85 =							127.5	Kpa		
New Af							0.721569	m^2	721568.6275	mm^2
New b							0.849452	m	849.4519571	mm
USE							1	m	1000	mm
qapp=	92	<	150	checked						
Final A =							1	m^2		
ab = (b-hc)*1/2							0.25	m	250	mm
Shear Capacity										
qf=Pf/Af=							102.25	KN/m^2		
One Way							0.10225	N/mm^2		
Vf = qf*b*(ab-d)			Vc = 0.2*ϕc*sprt(F'c)*b*d							
solve for d										
Vf=	qf*b*ab -	qf*b*d								
Vc=	0.2*0.65*sqrt(f'c)*b*d									
	qf*b*ab=	(0.2*0.65*sqrt(f'c)*b + qf*b)d								
	d=	(qf*ab)/(0.2*0.65*sqrt(f'c) + qf)					31.3924	mm		
USE d=							75	mm		
							0.075	m		
Check										
Vf							25.5625	KN	25562.5	N
Vc							53.40295	KN	53402.94936	N

Vf < Vc							Checks			
Table 9.11										
ab =							250	mm		
Bar Size =						6	10	M	11.3	mm
A bar							100	mm^2		
Thickness										
d+depth to bury bar+barsize/2										
depth =	75	mm					155	mm		
Round Up to next 100							200	mm		
Two Way Shear										
Vf =	qf*(b^2 - (hc-2d/2)^2)						83.78109	KN		
bod=	4(hc+2d/2)*d						0.1725	m^2	172500	mm^2
bo=							2.3	m	2300	mm
Vf/bod =							485.6875	KN/m^2		
							0.485688	Mpa		
vr =>	0.4*ϕc*SQRT(f'c)						1.424079			
	(1+(2/Bc))*.2*ϕc*SQRT(f'c)						2.136118			
	((αs*d/bo)+0.2)*ϕc*SQRT(f'c)						1.176413	1.176413		MPA
Vf =	0.485688	vr =	1.176413							
	Vf	<	vr				CHECKS			
Steel Select										
Mf=	qf*(b/2)*((b-c)/2)=						12.78125	KN*m		
Kr=	(Mf*10^6)/(b*d^2)						2.272222			
Table 2.1 Interpolation										
ρ=	0.67	%					0.0067			
As = ρ*b*d							0.000503	m^2		
							502.5	mm^2		
As min=	0.002*Ag=	0.002*b*t					0.0004	m^2		
							400	mm^2		
Governing							502.5			
# bars										
As/ab=							5.025			
USE							6.0	bars		
Spacing										
s=(b-2*75-bars*SizeM)/(#bars-1)							146.6	mm		
3 checks for spacing										
S > or =	14*dia of M						158.2			
	16*M						160			
	400						400			
Max =							146.6	mm		

Designer: Lindsey Miller				Foundation Design					1/24/2013	
Checked By:										
					Factors					
					Footing 5					
		f'c=	30	MPa	30	N/mm^2	design criteria			
		Fy=	400	MPa	400	N/mm^2	assumed			
		hc=	0.5	m	500	mm	assumed			
		qsr=	150	kPa	150		design criteria			
		factored lo	10.23	KPa	0.009013	N/mm^2				
		unfactored	9.20	KPa	0.007354	N/mm^2				
		Tributary A	6	m^2	6.00E+06	mm^2				
		ϕc	0.65	ϕs	0.85					
					Footing 5					
Tributary Area							6	m^2		
Factored Loading		Pf=TA*loading=					61.35	KN	61350	N
Unfactored Loading		P=TA*loading=					55.2	KN		
Pf>Fbr = 0.85*ϕc*f'c*Ac			meaning	Pf/(0.85*ϕc*f'c) = Ac			3701.357	mm^2		
hc= SQRT(Ac)							60.83878	mm		
USE							500	mm		
Bearing Capacity										
qapp = P/Af <=qallow		Af=					0.368	m^2		
b = sqrt (Af)							0.60663	m		
Design for 85%										
qsr*.85 =							127.5	Kpa		
New Af							0.432941	m^2	432941.1765	mm^2
New b							0.657983	m	657.9826567	mm
USE							1	m	1000	mm
qapp=	55.2	<	150	checked						
Final A =							1	m^2		
ab = (b-hc)*1/2							0.25	m	250	mm
Shear Capacity										
qf=Pf/Af=							61.35	KN/m^2		
One Way							0.06135	N/mm^2		
Vf = qf*b*(ab-d)			Vc = 0.2*ϕc*sprt(F'c)*b*d							
solve for d										
Vf=	qf*b*ab -	qf*b*d								
Vc=	0.2*0.65*sqrt(f'c)*b*d									
	qf*b*ab=	(0.2*0.65*sqrt(f'c)*b + qf*b)d								
	d=	(qf*ab)/(0.2*0.65*sqrt(f'c) + qf)					19.83154	mm		
USE d=							75	mm		
							0.075	m		
Check										
Vf							15.3375	KN	15337.5	N
Vc							53.40295	KN	53402.94936	N

Vf < Vc							Checks			
Table 9.11										
ab =							250	mm		
Bar Size =						6	10	M	11.3	mm
A bar							100	mm^2		
Thickness										
d+depth to bury bar+barsize/2										
depth =	75	mm					155	mm		
Round Up to next 100							200	mm		
Two Way Shear										
Vf =	qf*(b^2 - (hc-2d/2)^2)						50.26866	KN		
bod=	4(hc+2d/2)*d						0.1725	m^2	172500	mm^2
bo=							2.3	m	2300	mm
Vf/bod =							291.4125	KN/m^2		
							0.291413	Mpa		
vr =>	0.4*ϕc*SQRT(f'c)						1.424079			
	(1+(2/Bc))*.2*ϕc*SQRT(f'c)						2.136118			
	((αs*d/bo)+0.2)*ϕc*SQRT(f'c)						1.176413	1.176413		MPA
Vf =	0.291413	vr =	1.176413							
	Vf	<	vr				CHECKS			
Steel Select										
Mf=	qf*(b/2)*((b-c)/2)=						7.66875	KN*m		
Kr=	(Mf*10^6)/(b*d^2)						1.363333			
Table 2.1 Interpolation										
ρ=	0.37	%					0.0037			
As = ρ*b*d							0.000278	m^2		
							277.5	mm^2		
As min=	0.002*Ag=	0.002*b*t					0.0004	m^2		
							400	mm^2		
Governing							400			
# bars										
As/ab=							4			
USE							6.0	bars		
Spacing										
s=(b-2*75-bars*SizeM)/(#bars-1)							146.6	mm		
3 checks for spacing										
S > or =	14*dia of M						158.2			
	16*M						160			
	400						400			
Max =							146.6	mm		

Designer: Lindsey Miller						Foundation Design			1/24/2013	Desig
Checked By:										Checl
						Factors				
						Pedestal 1				
f'c=		30	MPa	30	N/mm^2	Tributary Area		45	m^2	f'c=
Fy=		400	MPa	400	N/mm^2			4.50E+07	mm^2	Fy=
hc=		0.5	m	500	mm					hc=
qsr=		150	kPa	150			ϕs	0.85		qsr=
factored loading		10.23	KPa	0.00901	N/mm^2		ϕc	0.65		facto
unfactored		9.2	KPa	0.00735	N/mm^2		α1=	0.85		unfac
Winward		1.5164164	KPa				β1	1		Winv
Leeward		-1.375354	KPa							Leev
Tributary Area						45	m^2			Tribu
Factored Loading		Pf=TA*loading=				460.125	KN	460125	N	Facto
Unfactored Loading		P=TA*loading=				414	KN			Unfa
Pf>Fbr = 0.85*ϕc*f'c*Ac			meaning	Pf/(0.85*ϕc*f'c) = Ac		27760.181	mm^2			Pf>Fb
hc= SQRT(Ac)						166.613868	mm			hc= S
USE						500	mm			USE
Area	Width	Wind Bearir	Length	Height	TA	Panel	P	Pf	M	Area
	m		m	m	m^2	m^2	kN	kN	kN*m	
1	4.5	<	10	8	45	36	414	460.125	34.70125	
Ag =						250000	mm^2	0.25	m^2	Ag =
b=						500	mm	0.5	m	b=
d = standard * 2						150	mm	0.15		d = st
H of column						1000	mm	1	m	H of c
Kr =	M/(b*d^2)					3084.555596	kPa	3.084555596	Mpa	Kr =
Table 2.1	ρ =					1.03	%	0.0103		Table
As =	ρ*b*d					772.5	mm^2	0.0007725	m^2	As =
As min =	0.002*b*h					1000	mm^2	0.001	m^2	As mi
Min - governs										Min -
eccentricit	e=	M/P=				0.075417007	m	75.41700724	mm	eccer
γ=	γH/H					0.7	ratio			γ=
Table 7.2.										Table
Max Steel										Max S
#bar						20	M			#bar
number of bars						4				numb
table 9.11						300	mm^2			
						19.5	mm			
Area of rebar						1200	mm^2			Area
Min As	check					1000				Min A

As of ties	> 30% of dia of lrgst bar					5.85				As of
A of 10 M						11.3				A of 1
Pro =	Pc+Ps =	α1*ϕc*f'c*(Ag-As)+ϕs*fy*As				4.467175	N			Pro =
for when no e										for w
Pr=	0.8*Pro					3.57374	N			Pr=
Check on Table 7.4.10										Checl
ρ=						0.0103				ρ=
P/Ag						1840.5	kpa	1.8405	Mpa	P/Ag
M/(Ag&H)						138.8050018	kpa	0.138805002	Mpa	M/(A
Checks										Checl
even with just axial (Pr) still checks by table.										even
Spacing										Spaci
s=(b-2d-bars*SizeM-ties*dia/(#bars-1)							139.7	mm		s=(b-
3 checks for spacing										3 che
S > or =	14*dia of M						158.2			S > oi
	16*M						160			
	400						400			
Max =							139.7	mm		Max =

						Pedestal 2				
f'c=		30	MPa	30	N/mm^2	Tributary Area		22.5	m^2	f'c=
Fy=		400	MPa	400	N/mm^2			2.25E+07	mm^2	Fy=
hc=		0.5	m	500	mm					hc=
qsr=		150	kPa	150			ϕs	0.85		qsr=
factored loading		10.23	KPa	0.00901	N/mm^2		ϕc	0.65		facto
unfactored		9.2	KPa	0.00735	N/mm^2		α1=	0.85		unfac
Winward		1.5164	KPa				β1	1		Winv
Leeward		-1.375	KPa							Leev
Tributary Area						22.5	m^2			Tribu
Factored Loading		Pf=TA*loading=				230.0625	KN	230062.5	N	Facto
Unfactored Loading		P=TA*loading=				207	KN			Unfa
Pf>Fbr = 0.85*ϕc*f'c*Ac			meaning	Pf/(0.85*ϕc*f'c) = A		13880.0905	mm^2			Pf>Fb
hc= SQRT(Ac)						117.813796	mm			hc= S
USE						500	mm			USE
Area	Width	Wind Be	Length	Height	TA	Panel	P	Pf	M	Area
	m		m	m	m^2	m^2	kN	kN	kN*m	
2	4.5	<	5	8	22.5	36	207	230.0625	34.70125	
Ag =						250000	mm^2	0.25	m^2	Ag =
b=						500	mm	0.5	m	b=
d = standard * 2						150	mm	0.15		d = st
H of column						1000	mm	1	m	H of c
Kr =	M/(b*d^2)					3084.5556	kPa	3.084555596	Mpa	Kr =
Table 2.1	ρ =					1.03	%	0.0103		Table
As =	ρ*b*d					772.5	mm^2	0.0007725	m^2	As =
As min =	0.002*b*h					1000	mm^2	0.001	m^2	As mi
Min - governs										Min -
eccentricit	e=	M/P=				0.15083401	m	150.8340145	mm	eccer
γ=	γH/H					0.7	ratio			γ=
Table 7.2.										Table
Max Steel										Max S
#bar						20	M			#bar
number of bars						4				numb
						300	mm^2			
						19.5	mm			
Area of rebar						1200	mm^2			Area
Min As	check					1000				Min A

As of ties	> 30% of dia of lrgst bar					5.85					As of
A of 10 M						11.3					A of 1
Pro =	Pc+Ps =	α1*ϕc*f'c*(Ag-As)+ϕs*fy*As				4.467175	N				Pro =
for when no e											for w
Pr=	0.8*Pro					3.57374	N				Pr=
Check on Table 7.4.10											Checl
ρ=						0.0103					ρ=
P/Ag						920.25	kpa	0.92025	Mpa		P/Ag
M/(Ag&H)						138.805002	kpa	0.138805002	Mpa		M/(A
Checks											Checl
even with	just axial (Pr) still checks by table.										even
Spacing											Spaci
s=(b-2d-bars*SizeM-ties*dia/(#bars-1)							139.7	mm			s=(b-
3 checks for spacing											3 che
S > or =	14*dia of M						158.2				S > o
	16*M						160				
	400						400				
Max =							139.7	mm			Max =

					Pedestal 4						
f'c=		30	MPa	30	N/mm^2	Tributary Area		10	m^2		f'c=
Fy=		400	MPa	400	N/mm^2			1.00E+07	mm^2		Fy=
hc=		0.5	m	500	mm						hc=
qsr=		150	kPa	150			ϕs	0.85			qsr=
factored loading		10.23	KPa	0.009013	N/mm^2		ϕc	0.65			factoı
unfactored		9.2	KPa	0.007354	N/mm^2		α1=	0.85			unfac
Winward		1.516416	KPa				β1	1			Winw
Leeward		-1.37535	KPa								Leew
Tributary Area						10	m^2				Tribut
Factored Loading		Pf=TA*loading=				102.25	KN	102250	N		Facto
Unfactored Loading		P=TA*loading=				92	KN				Unfac
Pf>Fbr = 0.85*ϕc*f'c*Ac			meaning	Pf/(0.85*ϕc*f'c) = Ac		6168.9291	mm^2				Pf>Fb
hc= SQRT(Ac)						78.542531	mm				hc= S(
USE						500	mm				USE
Area	Width	Wind Bear	Length	Height	TA	Panel	P	Pf	M		Area
	m		m	m	m^2	m^2	kN	kN	kN*m		
4	2	>	5	8	10	16	92	102.25	15.422778		
Ag =						250000	mm^2	0.25	m^2		Ag =
b=						500	mm	0.5	m		b=
d = standard * 2						150	mm	0.15			d = sta
H of column						1000	mm	1	m		H of c
Kr =	M/(b*d^2)					1370.9136	kPa	1.3709136	Mpa		Kr =
Table 2.1	ρ =					0.43	%	0.0043			Table
As =	ρ*b*d					322.5	mm^2	0.0003225	m^2		As =
As min =	0.002*b*h					1000	mm^2	0.001	m^2		As mi
Min - governs											Min -
eccentricit	e=	M/P=				0.150834	m	150.83401	mm		eccen
γ=	γH/H					0.7	ratio				γ=
Table 7.2.											Table
Max Steel											Max S
#bar						20	M				#bar
number of bars						4					numb
						300	mm^2				
						19.5	mm				
Area of rebar						1200	mm^2				Area c
Min As	check					1000					Min A

As of ties	> 30% of dia of lrgst bar					5.85			
A of 10 M						11.3			
Pro =	Pc+Ps =	α1*ϕc*f'c*(Ag-As)+ϕs*fy*As				4.467175	N		
for when no e									
Pr=	0.8*Pro					3.57374	N		
Check on Table 7.4.10									
ρ=						0.0043			
P/Ag						409	kpa	0.409	Mpa
M/(Ag&H)						61.691112	kpa	0.0616911	Mpa
Checks									
even with	just axial (Pr) still checks by table.								
Spacing									
s=(b-2d-bars*SizeM-ties*dia/(#bars-1)							139.7	mm	
3 checks for spacing									
S > or =	14*dia of M						158.2		
	16*M						160		
	400						400		
Max =							139.7	mm	

Pedestal 5									
f'c=		30	MPa	30	N/mm^2	Tributary Area		3	m^2
Fy=		400	MPa	400	N/mm^2			3.00E+06	mm^2
hc=		0.5	m	500	mm				
qsr=		150	kPa	150			ϕs	0.85	
factored loading		10.23	KPa	0.009013	N/mm^2		ϕc	0.65	
unfactored		9.2	KPa	0.007354	N/mm^2		α1=	0.85	
Winward		1.516416	KPa				β1	1	
Leeward		-1.37535	KPa						
Tributary Area						3	m^2		
Factored Loading		Pf=TA*loading=				30.675	KN	30675	N
Unfactored Loading		P=TA*loading=				27.6	KN		
Pf>Fbr = 0.85*ϕc*f'c*Ac			meaning	Pf/(0.85*ϕc*f'c) = Ac		1850.679	mm^2		
hc= SQRT(Ac)						43.01952	mm		
USE						500	mm		
Area	Width	Wind Bear	Length	Height	TA	Panel	P	Pf	M
	m		m	m	m^2	m^2	kN	kN	kN*m
5	2	<	1.5	8	3	16	27.6	30.675	15.422778
Ag =						250000	mm^2	0.25	m^2
b=						500	mm	0.5	m
d = standard * 2						150	mm	0.15	
H of column						1000	mm	1	m
Kr =	M/(b*d^2)					1370.914	kPa	1.370914	Mpa
Table 2.1	ρ =					1.03	%	0.0103	
As =	ρ*b*d					772.5	mm^2	0.000773	m^2
As min =	0.002*b*h					1000	mm^2	0.001	m^2
Min - governs									
eccentricit	e=	M/P=				0.50278	m	502.78	mm
γ=	γH/H					0.7	ratio		
Table 7.2.									
Max Steel									
#bar						20	M		
number of bars						4			
						300	mm^2		
						19.5	mm		
Area of rebar						1200	mm^2		
Min As	check					1000			

As of ties	> 30% of dia of lrgst bar					5.85			
A of 10 M						11.3			
Pro =	Pc+Ps =	α1*ϕc*f'c*(Ag-As)+ϕs*fy*As				4.467175	N		
for when no e									
Pr=	0.8*Pro					3.57374	N		
Check on Table 7.4.10									
ρ=						0.0103			
P/Ag						122.7	kpa	0.1227	Mpa
M/(Ag&H)						61.69111	kpa	0.061691	Mpa
Checks									
even with just axial (Pr) still checks by table.									
Spacing									
s=(b-2d-bars*SizeM-ties*dia/(#bars-1)							139.7	mm	
3 checks for spacing									
S > or =	14*dia of M						158.2		
	16*M						160		
	400						400		
Max =							139.7	mm	

Designer: Lindsey Miller	Load Development Calculations	Job Number: 134231055
Checked by:		2/13/2013

Summary

Floor Loads

Dead Load=		3	kpa	62.655	psf
Live Load					
	At grade	25	kpa	522.125	psf

Roof Loads

Dead Load=	4.3	kpa	2.09	psf	3.1	D (no uplift)
Live Load=	1	kpa	20.89	psf		
Basic Snow Load=	3.15	kPa	65.772	psf		
Snow Drift Load=	0.75	kpa	15.66	psf		
Snow Total=	3.9			Xd=	-3.2	m

Wind Loads

Winward=	1.516416	kPa	31.67	psf
Leeward=	-1.37535	kPa	-28.72	psf
Uplift=	-2.0454	kPa	-42.72	psf

Seismic Load

5% % of dead Weight

Load Combinations

FLC

Max =	10.23	**kPa**
Min =	0.43	**kPa**

ULC

Max =	9.20	**kPa**
Min =	2.05	**kPa**

Footing

	Ac m^2	b mm	d mm	t mm	As (min) mm^2	bar type	# of bars	spacing mm
1	2.89	1700	150	300	1530	20M	8.0	200
2	1.44	1200	75	200	1611	20M	6	190
4	1	1	75	200	503	20M	6	150
7	1	1	75	200	400	20M	6	150

Pedestal

	Ag m^2	b mm	d mm	H mm	As (min) mm^2	spacing mm
1	0.25	500	150	1000	1000	140
2	0.25	500	150	1000	1000	140
4	0.25	500	150	1000	1000	140
5	0.25	500	150	1000	1000	140

	Rebar		Ties	
	Bar Type	#	Bar Type	#
1	20M	4	10M	2
2	20M	4	10M	2
4	20M	4	10M	2
5	20M	4	10M	2

Appendix E. Sustainable Material Selection

Please note: Industry scores and sustainable scores were determined independently of each other. Compare data when comparing the two

	Durability & Lifespan		Required Maintenance		Environmental Impact		
Industry Material	**Data**	**Score**	**Data**	**Score**	**Data**	**Score**	**Total (of 15)**
Cast in Place Concrete	100+	5	N/A	4	2	2	11
Pre-Cast Concrete	50-75	2	N/A	4	2.25	3	9
Structural Steel	50-100+	4	10-15 years	3	3.5	5	12
Insulated Concrete Form	75+	3	N/A	5	2.75	4	12
Concrete Masonry Unit	75+	3	N/A	4	1.75	1	8
Sustainable Material							**Total (of 14)**
Ductal (UHPC)	1000	5	Very low, sel	5	2	2	12
Ecosmart Concrete (CIP)	Default, unknown	2	Default inspe	4	2.25	3	9
Vulcraft (SS)	50-100+	3	10-15 years	4	3.75	5	12
Faswall (ICF)	200	4	Default inspe	4	3.25	4	12

Guidelines:

Welcome to the spreadsheet. There are a number of things to explain.

1. On this page, there are the two types of materials compared. The one with the highest score is the best. Scoring works based on data. The material with the best data gets 5 points, second best 4 points, and so on. Ties share point values.

2. The data comes from the Source Data Page. On the source data page, you will see notes and other scoring criteria. The data and the point values are not automated, and must be set by hand.

3. Lifespan scoring is determined by the longest lifespan. Durability factors in to how much maintenance is expect for a material. Concete, for example is durable, but what of the mortar? Steel may corrode without coating. In any event, there will still be inspections.

4. Sustainability was broken down into five categories because the field is complex. Materials required refers to whether fresh materials are needed for making this and the process to obtain the material. If all new material is needed or the process to obtain is costly, it is reflected. Next, the Life Cycle Analysis for the material is considered. The primary interest in looking at these is the Carbon dioxide equivalent generated per square unit of measurement. The fourth component is the recycling ability of the material. Concrete often has steel reinforcement & ICF has styrofoam, making both harder to recycle. Toxicity and hazards are also considered. Steel toxifies water. ICF has Styrofoam. Other concrete forms have emissions. Lastly, the lifespan is again considered. While there may seem to be overlap in categories, it is because these are important.

5. Sources to the data are in the third tab.

Scoring (1-5, 5 is highest)

		Durability & Lifespan		Required Maintenance		Environmental Impact		
Notes:	**Material**	**Data (yrs)**	**Score**	**Data**	**Score**	**Data**	**Score**	**Total (of 15)**
Builder advertised l	Cast in Place Concrete	100+	5	N/A	4	2	2	11
Florida Coastal Lifes	Pre-Cast Concrete	50-75	2	N/A	4	2.25	3	9
Toxicity in water, Fl	Structural Steel	50-100+	4	10-15 year	3	3.5	5	12
Styrofoam, Florida (	Insulated Concrete Form	75+	3	N/A	5	2.75	4	12
Florida Coastal Lifes	Concrete Masonry Unit	75+	3	N/A	4	1.75	1	8
		Note: Concrete holds up better than other material in harst conditions, but replacing the grout/mortar/cement is still required. This applies regardless of material.						
		Durability & Lifespan		**Required Maintenance**		**Environmental Impact**		
	Sustainable Material	**Data (Yrs)**	**Score**	**Data**	**Score**	**Data**	**Score**	**Total (of 14)**
	Ductal (UHPC)	1000	5	Very low,	5	2	2	12
Canadian?	Ecosmart Concrete (CIP)	Default, unl	2	Default in	4	2.25	3	9
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
With Corrosion prot	Vulcraft (SS)	50-100+	3	10-15 year	4	3.75	5	12
	Faswall (ICF)	200	4	Default in	4	3.25	4	12
		Note: Concrete holds up better than other material in harst conditions, but replacing the grout/mortar/cement is still required. This applies regardless of material.						

(Scoring, (0-1, 1 is best))						
Environmental Breakdown						
Resources required	LCA	Recycle	Toxic or Hazardous to make?	Lifespan	Data	Score (1-5)
0.25	0	0.25	0.5	1	2	
0.25	0.25	0.25	0.5	1	2.25	
0.5	0.75	0.75	0.5	1	3.5	
0.5	0.75	0	0.5	1	2.75	
0.25	0	0	0.5	1	1.75	

(Scoring, (0-1, 1 is best))						
Environmental Breakdown						
Resources required	LCA	Recycle	Toxic or Hazardous to make?	Lifespan	Data	Score (1-5)
0.25	0	0.25	0.5	1	2	
0.5	0	0.25	1	0.5	2.25	
1	0	1	1	0.75	3.75	
1	0	0.5	1	0.75	3.25	

LCA Breakdown	
Data	Score
N/A	2*
348 kg/m2	3
N/A	5
128-339kg/m2	4
110,000,000 kg/m2	1

*Guess. No data.

While no data is present, a value is given based on other LCA data, putting Steel ahead or comparable to Concrete

LCA Breakdown	
Data	Score
	0
	0
	0
	0

Due to limited LCA data, only conjecture is available for this section. Conjecture is not reliable, and the point values have been removed.