Simpson Gumpertz & Heger Inc.
Consulting Engineers

CLIENT ATRIUM
SUBJECT STEEL DESIGN

SHEET NO. 1
PROJECT NO. 120470.01
DATE 11 July 2014
BY ARGouveia
CHECKED BY

	1	2	3	4	5	6	7	8	9	10	11	12	23	24	31		32	
FLOOR	BEAM #	Type	Zx	L	Vu	Lb	Cb	x	Mu	Mn	P	a	Reinf.	DCR	l, weld ends	l, suggested	weld through	Reinf Type
4	**94**	W18X50	101	29.2	48.1	1	1	14.5	441.8	448.86	4.167	18.34	WT7X19	0.57	17.00	24.00	3 @ 12	1
4	**626**	W24X55	134	31	91.48	1	1	19.2	991.6	819.9	72.898	19.17	WT7X45	0.89	29.00	26.00	3 @ 12	2
3	**83**	W18X50	101	29.2	65.59	1	1	14.5	580.5	496.34	7.407	18.34	WT7X19	0.75	19.00	24.00	3 @ 12	1
3	**370**	W24X55	134	31	88.82	1	1	19.2	960	819.9	63.283	19.17	WT7X45	0.86	29.00	26.00	3 @ 12	2
3	**368**	W18X71	146	31	75.13	1	1	16	495.4	547.5	0.029	4.5	WT7X19	0.47	18.00	24.00	3 @ 12	1
2	**85**	W18X50	101	29.2	42.27	1	1	14.5	437.4	442.52	4.092	18.34	WT7X19	0.57	17.00	24.00	3 @ 12	1
2	**352**	W18X35	66.5	40.25	30.26	1	1	19.8	300	472.98	15.573	13	C8X13.7	0.90	16.00	16.00	3 @ 12	3
2	**417**	W18X65	133	31	73.63	1	1	19.2	779.9	746.97	58.359	19.17	WT7X19	0.80	24.00	24.00	3 @ 12	1
ROOF	**283**	W18X40	78.4	31	42.64	1	1	16.5	353.4	324.37	5.25	14.25	WT7X19	0.78	14.00	14.00	3 @ 12	1
ROOF	**304**	W18X40	78.4	31	43.95	1	1	16.5	372.1	324.37	7.35	14.25	WT7X19	0.82	14.00	14.00	3 @ 12	1
ROOF	**350**	W18X40	78.4	31	43.95	1	1	16.3	367.7	336.12	6.1	14	WT7X19	0.81	14.00	14.00	3 @ 12	1
ROOF	**554**	W6X20	14.9	13.67	2.8	1	1	8	18.2	13.34	3.85	6.6	WT7X19	0.11	35.00	35.00	3 @ 12	1
ROOF	**165**	W18X40	78.4	31	44.58	1	1	15.5	348	336	5.924	10	WT7X19	0.77	14.00	14.00	3 @ 12	1
ROOF	**142**	W18X40	78.4	31	43.27	1	1	15.6	358.6	336.12	8.074	7	WT7X19	0.79	14.00	14.00	3 @ 12	1
ROOF	**101**	W18X40	78.4	31	44.48	1	1	16	351.1	336.12	5.85	11	C3X3.5	1.57	5.00	5.00	3 @ 12	1
ROOF	**185**	W18X76	163	39	53.31	1	1	26	492.4	611.25	5	14.1	WT7X19	0.44	10.00	10.00	3 @ 12	1
ROOF	**225**	W21X68	160	31	53.82	1	1	10.5	538.8	600	35.5	10	WT7X19	0.48	10.00	10.00	3 @ 12	1
ROOF	**201**	W18X76	163	36.6	48.92	1	1	24	418.8	611.25	6.5	14.1	WT7X19	0.38	10.00	10.00	3 @ 12	1
ROOF	**211**	W18X55	112	34.17	50.59	1	1	21.5	424.3	420	9.2	14.1	WT7X19	0.50	12.00	12.00	3 @ 12	1
ROOF	**247**	W18X50	101	29.29	46.14	1	1	16.67	325.8	378.75	7.6	14	WT7X19	0.42	13.00	13.00	3 @ 12	1

Yes
No

Design of Reinforcement for Steel Members

Beam #: 94

Input User Values:

Member Shape:	W	W18X50		Elastic Modulus:	E	29000	ksi
Yield Strength:	F_y	50	ksi	LTB Coefficient (F1-1):	C_b	1	
Member Length:	L	29.2	ft	Distance from Reinforcement to			
Reinforcement Length:	L_R	23.2	ft	End Support:	d_r	3	ft
Braced Length:	L_b	1	ft				

Original Section Properties:

Depth:	d	18	in	Flange Thickness:	t_f	0.57	in
Width:	b_f	7.5	in	Web Thickness:	t_w	0.355	in
Area:	A	14.7	in^2		k	0.972	in
Moment of Inertia, x:	I_{xw}	800	in^4	Moment of Inertia, y	I_{yw}	40.1	in^4
Section Modulus:	S_x	88.9	in^3	Plastic Section Modulus, x:	Z	101	in^3
Polar Moment of Inertia:	J_w	1.24	in^4				

Reinforcement Properties

Leave unused sections = 0 / None

Option Currently Choosen:	WT7X19		
DCR	0.57	%	
Moment of Inertia Increase	109.36	%	
Total Weight	440.8	lbs	

Reinf. Yield Strength: F_{yr} = 36 in

Plate: None

Tension Plate Width:	w_{tp}		in	Comp. Plate Width:	wc_p		in
Tension Plate Thickness:	t_{tp}		in	Comp. Plate Thickness:	tc_p		in

Channel: C = None

Channel Depth:	d_{ch}	0	in	Channel Mom. of Inertia, x	I_{xch}	0	in^4
Channel Flange Width:	b_{fch}	0	in	Channel Mom. of Inertia, y	I_{ych}	0	in^4
Channel Flange Thickness:	t_{fch}	0	in	Channel Center of Mass from Y, x	y_{ch}	0	in^4
Channel Web Thickness:	t_{wch}	0	in	Channel Polar Mom. of Inertia, x	J_{ch}	0	in^4
Channel Area:	A_{ch}	0	in^2				

WT: WT = WT7X19

WT Depth:	d_{wt}	7.05	in	Channel Mom. of Inertia, x	I_{xwt}	23.3	in^4
WT Flange Width:	b_{fwt}	6.77	in	Channel Mom. of Inertia, y	I_{ywt}	13.3	in^4
WT Flange Thickness:	t_{fwt}	0.515	in	Center of Mass from Flange, x	y_{wt}	1.54	in^4

WT Web Thickness:	t_{wwt}	0.31	in	Channel Polar Mom. of Inertia, x	J_{wt}	0.398	in^4
WT Area:	A_{wt}	5.58	in^2				

Pre-Loading Conditions

Pre-Load Moment	M_{xi}	419.3282	kip.ft	Stress due to Pre-Load Mom.	f_{bxi}	56.60223	ksi
LTB Coefficient:	C_{bi}	1.220437					

Individual Section Properties

W-Section:

Neutral Axis	y_w	16.05	in	Tension Flange Mom. Inertia, y	I_{fy}	3645	in^4

Tension Side Plate:

Area	A_{tp}	0	in^2	Tension Flange Mom. Inertia, y	I_{tpy}	0	in^4
Polar Moment of Inertia	J_{tp}	0	in^4	Tension Flange Mom. Inertia, x	I_{tpx}	0	in^4
Neutral Axis:	y_{tp}	0	in				

Compression Side Plate:

Area	A_{cp}	0	in^2	Tension Flange Mom. Inertia, y	I_{cpy}	0	in^4
Polar Moment of Inertia	J_{cp}	0	in^4	Tension Flange Mom. Inertia, x	I_{cpx}	0	in^4
Neutral Axis:	y_{cp}	18	in				

Built Up Section Properties

Total Area:	A_{TOT}	20.28	in^2	Neutral Axis:	Y	12.0576	in
Depth:	D	25.05	in	ccomp:	c_{comp}	12.9924	in
h0	h_0	17.43	in	ctens:	c_{tens}	12.0576	in
Moment of Inertia, x	I_x	1674.866	in^4	Moment of Inertia, y:	I_y	53.4	in^4
Polar Moment of Inertia	J	1.638	in^4	Value used if J > 0:	J'	1.638	in^4
Radius of Gyration, x	r_x	9.087744	in	Section Modulus Comp., x	S_{xcomp}	128.911	in^3
Radius of Gyration, y:	r_y	1.62	in	Section Modulus Tension, x	S_{xtens}	138.905	in^3
Plastic Modulus'	Z'_x	105.3997	in^3	Plastic Modulus	Z_x	236.5855	in^3

AISC Specifications

F4-12	a_w	1.333		F4-7	L_p	3.58	ft
F4-11	r_t	1.468	in	F4-6a	F_L	35	ksi
F4-8	L_r	12.420	ft	F4-6B	F'_L	35	ksi
F4-5	F_{cr}	4289.145	ksi		(Lb/rt)^2	66.85764	

Member Capacity

Original Member Capacity

Original Member, F4-5	F_{cr0}	5235.60	ksi	Elastic LTB moment of reinf member, full length:	M_{e0}	38787.07	kip.ft
Reinforced Member J>0	F'_{cr}	4289.14	ksi				
Modified LTB for Partial Length Reinforcement:	C'_b	0.051		Elastic LTB moment of original member:	M_{er}	46076.59	kip.ft
				Factor	β_{LTB}	0.051	

Reinforced Member Capacity, Specification F4

Mp	M_p	859.41	kip.ft
Myc, F4-4	M_{yc}	537.13	kip.ft

Compression Flange Yielding

F4-9/F4-10	R_{pc}	1.600	
F4-1	M_{nCFY}	859.41	kip.ft

Tension Flange Yielding

F4-15/F4-16	M_{nTFY}	859.41	kip.ft

Lateral Torsional Buckling

F4-2/F4-3	M_{nLTB}	859.41	kip.ft

Reinforced Section Capacity

ϕMn	ϕM_n	773.47	kip.ft

Section Demand

	M_u	441.8	kip.ft
DCR	%	0.57	%