SEVERKO www.severko.com	PROJECT NAME: TELKWA 62.20 BULKLEY RIVER CROSSING WIDENING OF 24.0m SPAN, TPG BRIDGE	CNRAIL0802	PAGE NO OF
	TASK: 7.1. PILES	DGT	CHECKED BY:
	SUBTASK: 7.1.5. STRUCTURAL DESIGN	DATE: 31-Dec-08	DATE:

PILES AT THE ABUTMENT

	SERV_III			STRESSES							
	axial	moment (week-axis)	moment (strong-axis)	axial , fa	fa/Fa	fb1(strong-axis)	fb1/Fb1*A1	fb2 (week-axis)	fb2/Fb2*A2	total stress ratio	ADEQUACY
PILE	kN	kN-m	kN-m	MPA		MPA		MPA			
FRAME #											
1	-467.127	15.4117	139.1454	33.85	0.18	79.51	0.41	26.34	0.14	0.73	GOOD
23	-390.686	18.7944	133.5254	28.31	0.15	76.30	0.40	32.13	0.17	0.71	GOOD
45	-641.211	72.8961	-36.0696	46.46	0.24	20.61	0.11	124.61	0.65	1.00	GOOD
67	-641.34	73.4119	-34.5436	46.47	0.24	19.74	0.10	125.49	0.65	1.00	GOOD
89	-651.01	73.9359	-32.2786	47.17	0.25	18.44	0.10	126.39	0.66	1.00	NOT GOOD
111	-671.632	74.4468	-29.9704	48.67	0.25	17.13	0.09	127.26	0.66	1.01	NOT GOOD
133	-701.719	74.9391	-28.3555	50.85	0.26	16.20	0.08	128.10	0.67	1.02	NOT GOOD
168	185.543	18.8392	129.7882	13.45	0.07	74.16	0.39	32.20	0.17	0.62	GOOD
190	189.661	18.275	130.8737	13.74	0.07	74.78	0.39	31.24	0.16	0.62	GOOD
222	188.166	17.587	131.8119	13.64	0.07	75.32	0.39	30.06	0.16	0.62	GOOD
244	179.328	16.7829	132.7564	12.99	0.07	75.86	0.39	28.69	0.15	0.61	GOOD
270	162.913	16.0947	133.7826	11.81	0.06	76.45	0.40	27.51	0.14	0.60	GOOD
294	136.935	15.855	134.9934	9.92	0.05	77.14	0.40	27.10	0.14	0.59	GOOD
AXIAL-GEOTECH	-701.72										

WE CAN AFFIRM THAT THE PILES ARE O.K., SINCE THE STRESS RATIO FOR service III only is just at the maximum allowable.

1.3.14 COMBINED STRESSES (1994)

1.3.14.1 Axial Compression and Bending[1]

Members subject to both axial compression and bending stresses shall be proportioned to satisfy the following requirements:

when $\frac{f_a}{F_a} \le 0.15$

$$\frac{f_a}{F_a} + \frac{f_{b1}}{F_{b1}} + \frac{f_{b2}}{F_{b2}} \le 1.0$$

when $\frac{f_a}{F_a} > 0.15$

$$\frac{f_a}{F_a} + \frac{f_{b1}}{F_{b1}\left[1 - \frac{f_a}{200 \times 10^6}\left(\frac{k_1 l_1}{r_1}\right)^2\right]} + \frac{f_{b2}}{F_{b2}\left[1 - \frac{f_a}{200 \times 10^6}\left(\frac{k_2 l_2}{r_2}\right)^2\right]} \le 1.0$$

and, in addition, at points braced in the planes of bending,

$$\frac{f_a}{0.55F_y} + \frac{f_{b1}}{F_{b1}} + \frac{f_{b2}}{F_{b2}} \le 1.0$$

where:

F_y = yield point of the material as specified in Table 15-1-1

F_a = axial stress that would be permitted if axial force alone existed

F_{b1} and F_{b2} = compressive bending stress about axes 1-1 and 2-2, respectively, that would be permitted if bending alone existed

f_a = computed axial stress

f_{b1} and f_{b2} = computed compressive bending stress about axes 1-1 and 2-2, respectively, at the point under consideration

$\frac{k_1 l_1}{r_1}$ and $\frac{k_2 l_2}{r_2}$ = ratios of the effective length in inch to the radius of gyration in inch, of the compression member about axes 1-1 and 2-2, respectively

MAX Lu= 0 mm
maxkLu= 0 mm
kLu/rmin= .=0/88.6= 0.00
kLu/max= .=0/88.6= 0.00
3388/√Fy= .=3388/sqrt(350)= 181.0962175
0 < 181.0962175

Stress Area	Pounds per square inch
Axial compression, gross section: For stiffeners of beams and girders For splice material For compression members centrally loaded, when $kl/r \le 3388/\sqrt{F_y}$ when $3388/\sqrt{F_y} < kl/r < 27111/\sqrt{F_y}$ when $kl/r \ge 27111/\sqrt{F_y}$ where: kl is the effective length of the compression member, inch under usual conditions	See Article 1.7.7c $0.55F_y$ $0.55F_y$ $0.60F_y - \left(\frac{F_y}{1662}\right)^{3/2}\frac{kl}{r}$ $\frac{147,000,000}{(kl/r)^2}$
Compression in extreme fibers of I-type members subjected to loading perpendicular to the web	$0.55F_y$

Stress Area	Pounds per square inch
Compression in extreme fibers of welded built-up or rolled beam flexural members symmetrical about the principal axis in the plane of the web (other than box-type flexural members), and compression in extreme fibers of rolled channels, the larger of the values computed by the following formulas where: l = distance between points of lateral support for the compression flange, inch. r_y = minimum radius of gyration of the compression flange and that portion of the web area on the compression side of the axis of bending, about an axis in the plane of the web, inch. A_f = area of the smaller flange excluding any portion of the web, inch^2 d = overall depth of the member, inch.	(Note 1) $0.55F_y - \frac{0.55(F_y)^2}{1.8\times 10^9}\left(\frac{l}{r_y}\right)^2$ or $\frac{10,500,000}{ld/A_f}$ but not to exceed: $0.55F_y$

Fa= 192.5 MPa
Fb1= 192.5 MPa
Ifl= .=370^3/12+160*13^3/12= 4250376.67 mm4
Afl= .=370*13+160*13= 6890.00 mm2
ry= .=√Ifl/Afl= 24.84 mm
Fb2= .=0.55Fy-0.55*(Fy)^2/1.8/10^9*(1/ry)^2= 191.68 MPA

1.3.14.3 Allowable Stresses for Combinations of Loads or Wind Forces Only

a. Members subject to stresses resulting from dead load, live load, impact load and centrifugal force shall be designed so that the maximum stresses do not exceed the basic allowable stresses of Section 1.4, Basic Allowable Stresses, and the stress range does not exceed the allowable fatigue stress range of Article 1.3.13.

b. The basic allowable stresses of Section 1.4, Basic Allowable Stresses shall be used in the proportioning of members subject to stresses resulting from wind forces only, as specified in Article 1.3.8.

PILES AT THE ABUTMENT

	SERV_I_permanent loads			STRESSES							
	axial	moment (week-axis)	moment (strong-axis)	axial , fa	fa/Fa	fb1(strong-axis)	fb1/Fb1*A1	fb2 (week-axis)	fb2/Fb2*A2	total stress ratio	ADEQUACY
PILE	kN	kN-m	kN-m	MPA		MPA		MPA			
FRAME #											
1	-443.107	-1.9376	35.844	32.11	0.17	20.48	0.11	3.31	0.02	0.29	GOOD
23	-443.104	1.9373	35.84	32.11	0.17	20.48	0.11	3.31	0.02	0.29	GOOD
45	-540.643	21.9419	-4.3177	39.18	0.20	2.47	0.01	37.51	0.20	0.41	GOOD
67	-523.399	22.0406	-2.5745	37.93	0.20	1.47	0.01	37.68	0.20	0.40	GOOD
89	-517.053	22.0823	0.0005194	37.47	0.19	0.00	0.00	37.75	0.20	0.39	GOOD
111	-523.402	22.0414	2.5755	37.93	0.20	1.47	0.01	37.68	0.20	0.40	GOOD
133	-540.649	21.9433	4.3188	39.18	0.20	2.47	0.01	37.51	0.20	0.41	GOOD
168	-87.592	1.7862	34.0949	6.35	0.03	19.48	0.10	3.05	0.02	0.15	GOOD
190	-69.188	1.3708	34.2605	5.01	0.03	19.58	0.10	2.34	0.01	0.14	GOOD
222	-59.919	0.5078	34.3355	4.34	0.02	19.62	0.10	0.87	0.00	0.13	GOOD
244	-59.918	-0.507	34.3276	4.34	0.02	19.62	0.10	0.87	0.00	0.13	GOOD
270	-69.185	-1.37	34.2539	5.01	0.03	19.57	0.10	2.34	0.01	0.14	GOOD
294	-87.586	-1.7855	34.0892	6.35	0.03	19.48	0.10	3.05	0.02	0.15	GOOD
MAX AXIAL	-540.65										

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